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December, 1938

Volume 112 *No. 12*

MATERIAL

is only part of the cost

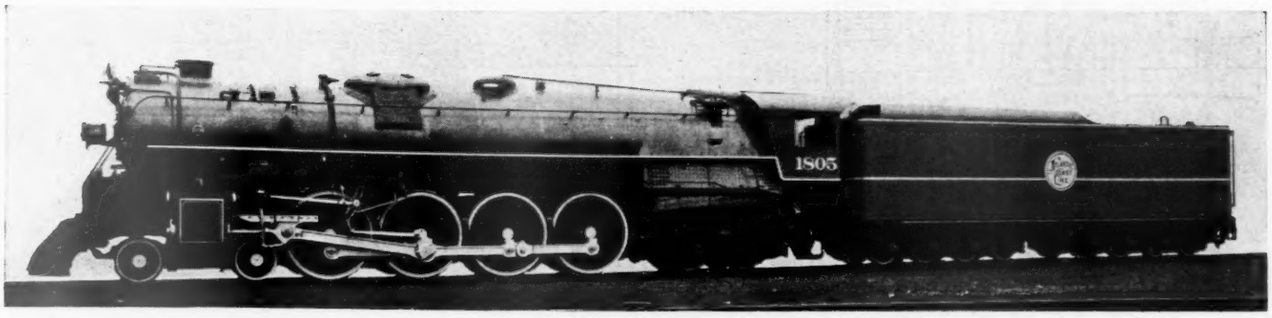
Two pieces of steel, one Republic Alloy Steel and one ordinary steel, when forged and turned into axles look identical—it might be impossible to tell them apart. » » » They both cost the same for labor of forming—Republic costs just a few cents more for material. » » » But the Republic Alloy Steel axle has higher strength and toughness and greater fatigue resistance that gives it longer life, greater resistance to wear and correspondingly lower maintenance costs. » » » Republic Alloy Steel used for crankpins, rods, axles, engine bolts and other highly stressed parts safeguards locomotive performance, minimizes idle time for maintenance and insures maximum locomotive earning capacity. » » » In addition Republic makes many other money-saving materials for railroad use, including Toncan* Iron pipe and sheets, Electrunite* boiler tubes and Upson track materials. Address Department RA, Republic Steel Corporation. General offices: Cleveland, Ohio; Alloy Steel Division: Massillon, Ohio. » » » »

*Reg. U. S. Pat. Off.

REPUBLIC STEEL

STEEL AND TUBES, INC.
TRUSCON STEEL COMPANY
UNION DRAWN STEEL DIVISION
NILES STEEL PRODUCTS DIVISION
BERGER MANUFACTURING DIVISION

REPUBLIC STEEL
REG. U. S. PAT. OFF.



Atlantic Coast Line locomotive for fast, heavy passenger-train service, built by Baldwin

A. C. L. 4-8-4 Locomotives

Largest locomotives in the South purchased from Baldwin for service on Florida trains —Designed to handle 21 standard cars

DURING the late summer the Atlantic Coast Line took delivery on 12 heavy 4-8-4 type passenger locomotives, built at the Baldwin Locomotive Works, which are now being used on the fast, heavy passenger trains between Richmond, Va., and Jacksonville, Fla., a distance of 681 miles. This motive power has exceptional capacity, with a starting tractive force of 63,900 lb. and a potential boiler horsepower of 4,170. The railroad has designated this group as Class R-1 and has assigned the road numbers 1800 to 1811.

At the present time these locomotives are working on the A. C. L.'s "Tamiami" and "Havana Special" trains, north and southbound. The former are night runs between Richmond and Jacksonville and make the run of 681 miles in 13¼ hours, including ten stops in each direction, while the latter are mainly daylight trains which make their respective runs in 14 hrs. 15 min. southbound and 14 hrs. 5 min. northbound. These trains vary in consist with the traffic, but the locomotives will handle 20 and 21 standard cars at schedule speeds. The maximum grades encountered are 0.6 per cent and the curvature is 3 deg. maximum. Some of these locomotives are making over 18,000 miles a month and the group are now beginning to pass through the shop for light repairs after having run total mileages of over 75,000.

The Boiler

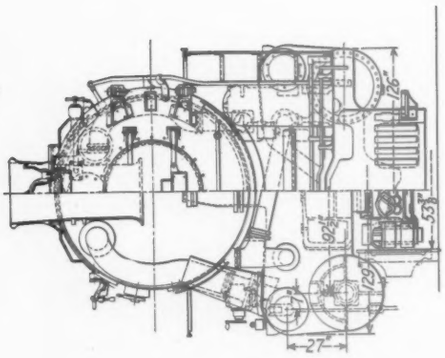
The boilers are of the conical type, built in three courses. The first and third courses are 84½ in. and 96$^{5}/_{16}$ in. inside diameter, respectively. The barrel plates in the three courses are nickel steel $^{27}/_{32}$ in., $^{15}/_{16}$ in. and $^{31}/_{32}$ in. thick. The combustion chamber is 72 in. long and the plate thickness is ⅜ in. There are 58 5½-in. flues and 198 2¼-in. tubes, 21 ft. over the tube sheets. The tube sheets are both ⅝-in. thick. The firebox plates are acid carbon steel. The firebox width is 102 in., with a length of 138 in. and a grate area of 97.75 sq. ft. The roof sheet is $^{13}/_{16}$ in. thick and the sides, inside throat and back head are ½ in. thick. The crown and sides are in one piece, ⅜ in. thick. The outside throat sheet is $^{27}/_{32}$ in. thick and the inside back furnace sheet is ⅜ in. The water spaces are 5 in. at the back and sides and 6 in. at the front. Three Thermic syphons are located in the firebox and one on the center line of the boiler in the combustion chamber. No arch tubes are used, the Security brick arch being supported on the syphons.

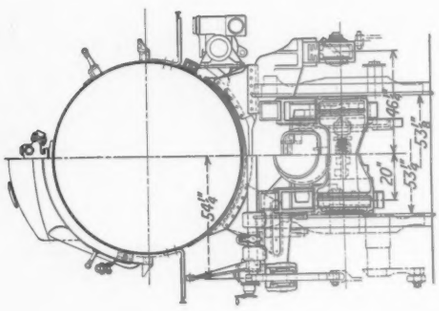
Welding and Staying

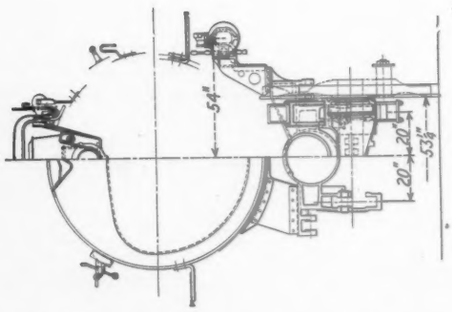
All of the seams inside the firebox are welded, including the seam in the combustion chamber. The sheets, inside and outside, are seal-welded to the mud ring for a distance of 12 in. each way from the corners. The syphons are welded into the firebox plates. The barrel course seams are welded for distances of from 11 in. to 16½ in. from the ends. The firedoor hole is welded.

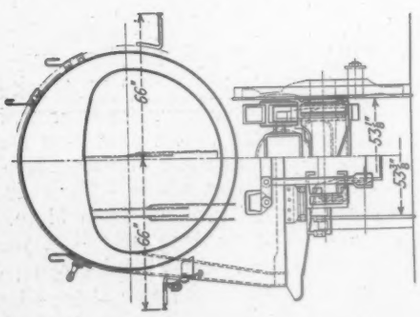
The dome is a one-piece open-hearth-steel forging 36 in. in diameter. The fireboxes and combustion chambers are stayed with Flannery bolts. Flexible bolts with U-type sleeves are used in the back head, combustion chamber and throat sheet. Expansion stays with WR sleeves and caps are used across the front four rows of the combustion chamber and along the crown-sheet bend. The crown stays in the 13 central rows are the taper-end type.

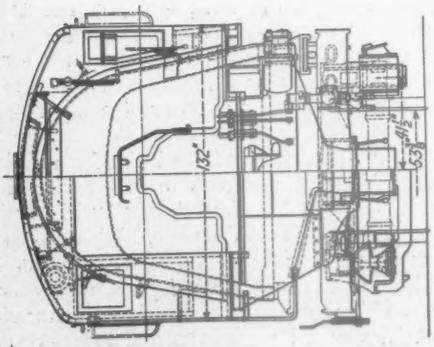
The firedoor opening is 25 in. by 25⅝ in. and a Franklin No. 8 Butterfly door is used. The grates are the railroad company's standard Rosebud design and bituminous coal is fed by a Standard HT stoker. Water is fed to the boiler by one Nathan 10,000-gal. capacity injector and by a Worthington Type 5½ SA feedwater heater. A 58-element Elesco Type A superheater, American multiple throttle and Tangential steam dryer form part of

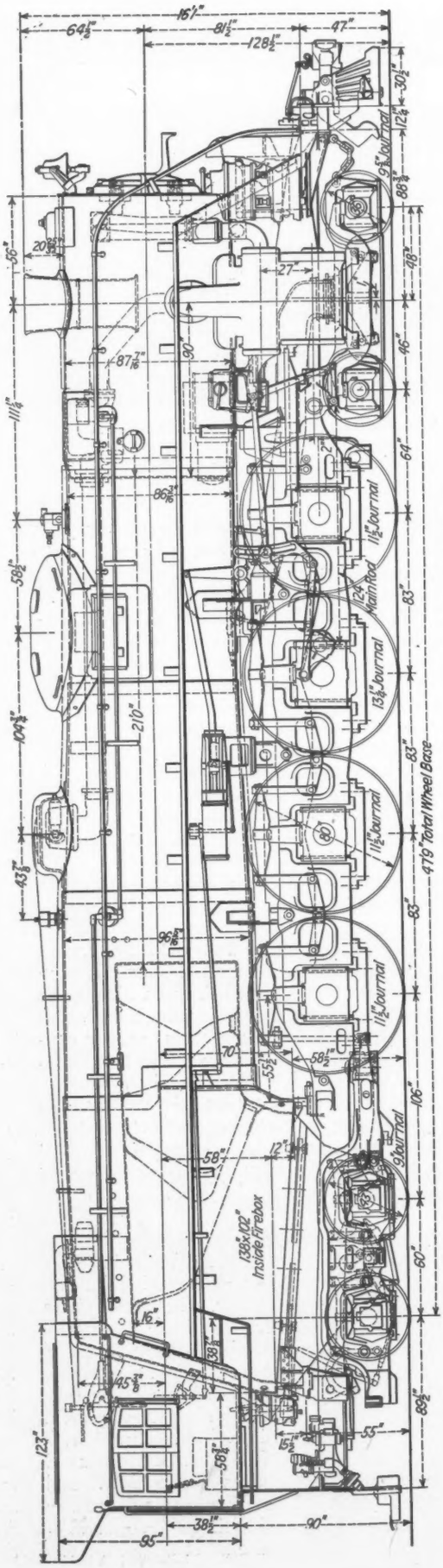












Elevation and cross-sections of the Atlantic Coast Line 4-8-4 type locomotives

the steam supply and control equipment. The feedwater heater is located ahead of the stack and both hot- and cold-water pumps are under the runboards on the left side.

Other boiler equipment consists of Okadee smokebox hinges, blow-off cocks and mufflers, and Consolidated 3½-in. safety valves.

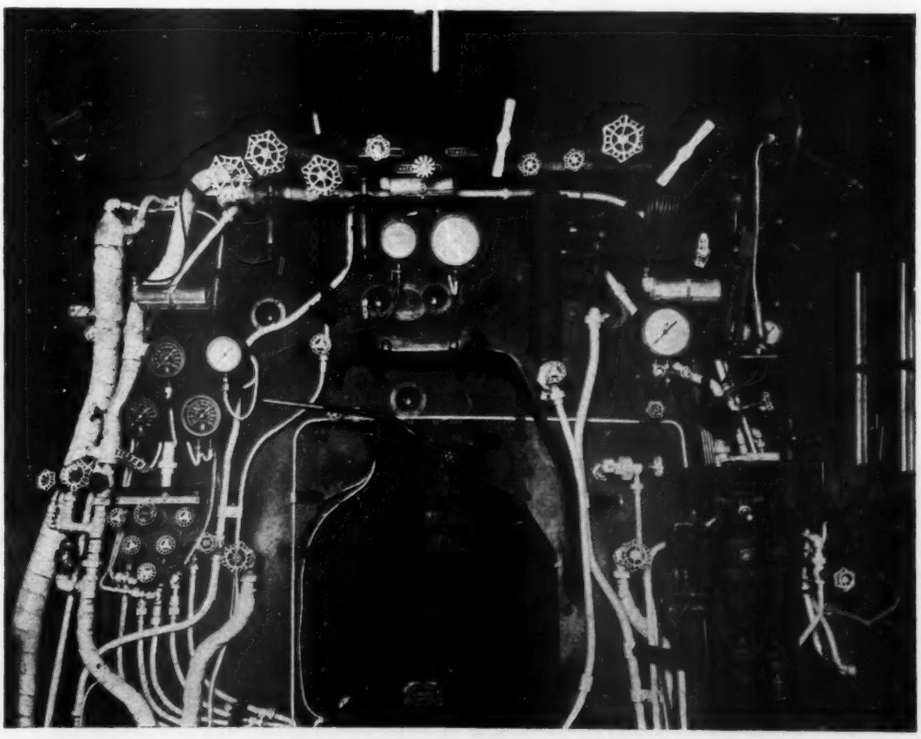
Machinery Details

A one-piece bed, supplied by the General Steel Castings Corporation, forms the foundation of these locomotives. Cast integral with the bed are the cylinders and back heads, main reservoirs, brackets for the air compressors, guide and valve-gear supports, brake hangers, firebox expansion pads and brackets for trailer-truck rockers. The steel pilot casting is designed to take a National Type E. drop coupler.

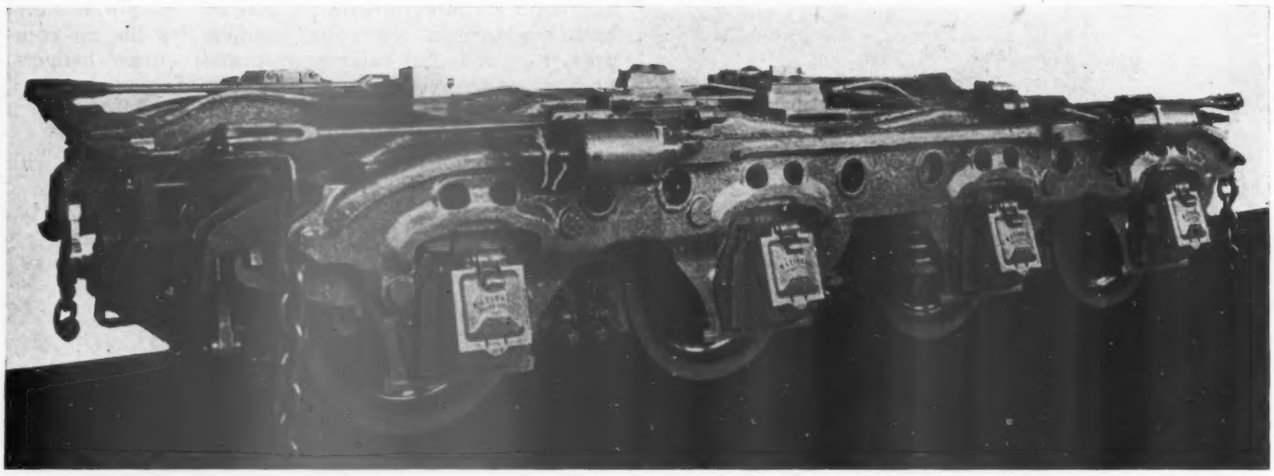
The front truck is of the constant-resistance type, with

General Dimensions, Weights and Proportions of the Atlantic Coast Line 4-8-4 Locomotives

Railroad	A. C. L.
Builder	Baldwin
Type of locomotive	4-8-4
Road class	R 1
Road numbers	1800—1811
Date built	April, 1938
Service	Passenger
Dimensions:	
Height to top of stack, ft. and in.	16— 1
Height to center of boiler, ft. and in.	10— 8½
Width overall, in.	132
Cylinder centers, in.	92½
Weights in working order, lb.:	
On drivers	263,127
On front truck	89,343
On trailing truck	107,800
Total engine	460,270
Tender	435,500
Wheel bases, ft. and in.:	
Driving	20— 9
Rigid	13—10
Engine, total	47— 9
Engine and tender, total	97—11
Wheels, diameter outside tires, in.:	
Driving	80
Front truck	36
Trailing truck	43
Engine:	
Cylinders, number, diameter and stroke, in.	2—27x30
Valve gear, type	Walschaert
Valves, piston type, size, in.	12
Maximum travel, in.	7½
Steam lap, in.	1⅛
Exhaust clearance, in.	¼
Lead, in.	¼
Boiler:	
Type	Conical
Steam pressure, lb. per sq. in.	275
Diameter, first ring, inside, in.	86 3/16
Diameter, largest, outside, in.	98¼
Firebox length, in.	138
Firebox, width, in.	102
Height mud ring to crown sheet, back, in.	74
Height mud ring to crown sheet, front, in.	92
Combustion chamber length, in.	72
Thermic syphons, number	Four
Tubes, number and diameter, in.	198—2¼
Flues, number and diameter, in.	58—5½
Length over tube sheets, ft. and in.	21—0
Fuel	Soft coal



The back head of the A.C.L. 4-8-4 type locomotives



These locomotives are equipped with the first eight-wheel tender trucks

Stoker	Standard HT
Grate area, sq. ft.	97.75
Heating surfaces, sq. ft.:	
Firebox and comb. chamber	399
Thermic syphons	169
Firebox, total	568
Tubes and flues	4,181
Evaporative, total	4,749
Superheating	1,497
Comb. evap. and superheat	6,246
Tender:	
Type	Rectangular
Water capacity, gallons	24,000
Fuel capacity, tons	27
Trucks	Eight-wheel
Journals, diameter and length, in.	6½x12
Rated tractive force, engine 85 per cent, lb.	63,900
Weight proportions:	
Weight on drivers ÷ weight, engine, per cent	57.2
Weight on drivers ÷ tractive force	4.12
Weight of engine ÷ evaporative heating surface	96.9
Weight of engine ÷ comb. heat. surface	73.7
Boiler proportions:	
Firebox heat. surface, per cent comb. heating surface	9.09
Tube-flue heat. surface, per cent comb. heat. surface	66.9
Superheat surface, per cent comb. heat. surface	24.0
Firebox heat. surface ÷ grate area	5.81
Tube-flue heat. surface ÷ grate area	42.8
Superheat. surface ÷ grate area	15.3
Comb. heat. surface ÷ grate area	63.9
Evaporative heat. surface ÷ grate area	48.6
Tractive force ÷ grate area	653.6
Tractive force ÷ evaporative heat. surface	13.5
Tractive force ÷ comb. heat. surface	10.2
Tractive force × diam. drivers ÷ comb. heat. surface	818.4

a swing of 6 in. each side of the center line and arranged for the future application of air brakes. The trucks were built by the General Steel Castings Corporation and have 36-in. wheels, 9⅝-in. journals and A. S. F. roller-bearing units. The trailing truck is the Delta four-wheel type with 43-in. wheels front and back, and 9-in. by 14-in. journals with plain bearings. It is arranged for the future application of a booster.

The driving wheels are of the Baldwin disc type mounted on axles running in Timken roller bearings. The main journals are 13¼ in. and the other three are 11½ in. The main wheels are cross balanced. Alco lateral-motion driving boxes are used on the front drivers.

The reciprocating weights on one side of the engine total 2,241 lb., 40 per cent of which are balanced. The dynamic augment at 80 m.p.h. is 10,780 lb.

The cylinders are two in number, 27 in. bore and 30 in. stroke. The piston valves are 12. in diameter and have a maximum travel of 7½ in. The piston heads are rolled steel. Elfur iron cylinder and valve-chamber bushings and packing rings, and King piston and valve-rod packing are part of the cylinder equipment.

The valve gear is Walschaert, operated by a Baldwin Type C power reverse gear. The guides are the multiple-bearing type with underhung cast-steel crossheads, furnished by the Standard Steel Works.

Two Nathan mechanical lubricators, type DV-7, each of 36 pints capacity, placed one on each side of the locomotive, supply oil to the valves and cylinders, the stoker, feedwater heater, main guides, valve stem guides, driving-box pedestals, front and back engine-truck pedestals, back truck floating hub liners, and link trunnions. Alemite lubrication is applied to the valve motion, spring rigging, brake work, connecting rods, throttle rigging and mechanical lubricator rigging.

The air-brake equipment is Westinghouse No. 8 ET with two 8½-in. compressors mounted on the bed in front of the smokebox. The locomotives are equipped with General Railway Signal intermittent, inductive, automanual train control.

Other equipment on the engines consists of Franklin radical buffers between the engine and the tender, Ashcroft steam, back-pressure and air gages, Prime clear vision windows, Sunbeam electric headlight and generator, Hancock steam-heat valves and Leslie pressure regulators. Barco flexible connections are used between the engine and the tender.

The Tenders

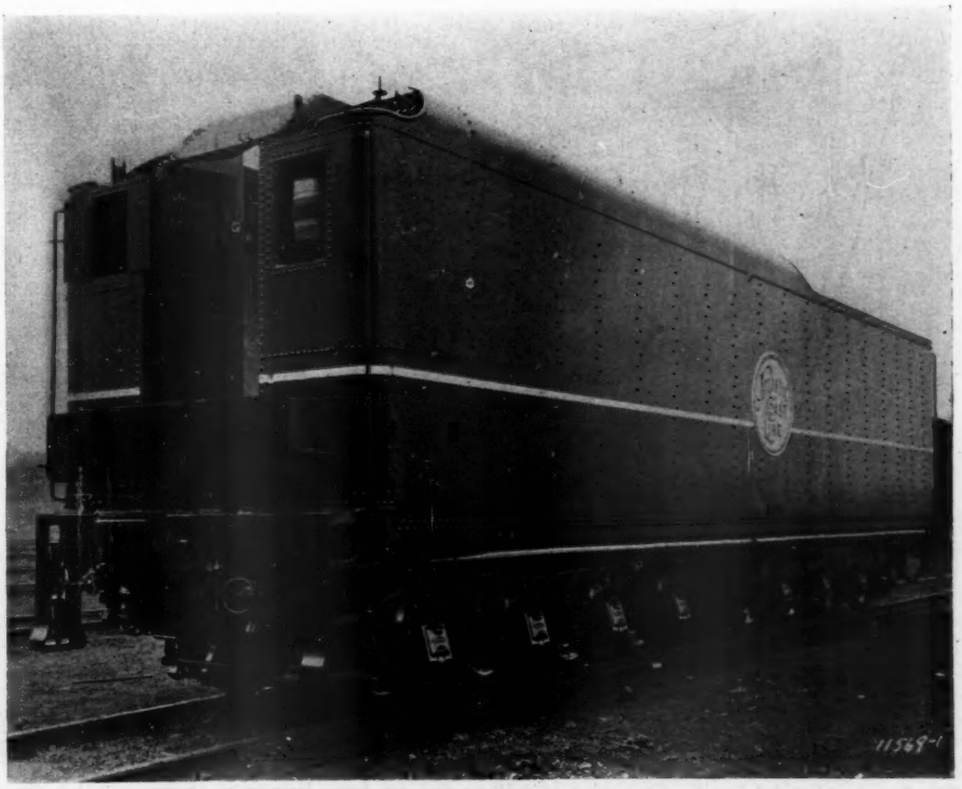
Long passenger train runs necessitated large tenders on these locomotives. They have a water capacity of 24,000 gal. and a fuel capacity of 27 tons of coal. They are the first to be carried on eight-wheel trucks. The tanks are of the rectangular type built of Cor-Ten steel plates. The tender frames and the truck frames are cast steel and were furnished by the General Steel Castings Corporation. The loaded weight of the tender is 435,-500 lb., an average of 27,200 lb. per wheel. The trucks have rigid frames and swing bolsters and are carried on 36-in. rolled-steel wheels, plain bearings and 6½-in. by 12-in. journals.

The tender trucks are equipped with Unit Cylinder clasp brakes with four independent cylinders on each truck. The braking ratio is 100 per cent at 50 lb. cylinder pressure.

The coupler at the rear end of the tender is a National Type E rotary passenger coupler with Miner A5XB draft gear and McConway & Torley yoke. Barco flexible steam-heat connectors are used at the rear of the tender.

Partial List of Materials and Equipment on the Atlantic Coast Line 4-8-4 Type Passenger Locomotives

Bed castings; engine and trailer trucks	General Steel Castings Corp., Eddystone, Pa.
Driving wheels	The Baldwin Locomotive Works, Philadelphia, Pa.
Driving and trailer tires; engine-truck wheel tires	American Locomotive Co., Railway Steel Spring Div., New York
Driving journal bearings	The Timken Roller Bearing Company, Canton, Ohio
Engine-truck bearings	American Steel Foundries, Chicago
Bearings, trailer (front and rear), tender	National Bearing Metals Corp., St. Louis Mo.
Springs	Standard Steel Works Co., Burnham, Pa.
Lateral motion device	American Locomotive Co., New York
Radial buffer, E-2	Franklin Railway Supply Co., Inc., New York
Mechanical lubricators	Nathan Manufacturing Co., New York
Grease lubrication	Alemite Div. Stewart-Warner Corp., Chicago
Air-brake equipment	Westinghouse Air Brake Co., Wilmerding, Pa.
Pump packing	U. S. Metallic Packing Co., Philadelphia, Pa.
Air gages	Locomotive Equipment Division of Manning, Maxwell & Moore, Inc., Bridgeport, Conn.
Foundation brake equipment	American Brake Co., St. Louis, Mo.
Train control	General Railway Signal Co., Rochester N. Y.
Piston rings and piston-valve rings; cylinder bushings and valve-chamber bushings of Elfur iron	Cramp Brass & Iron Foundries Co., Philadelphia, Pa.
Piston-rod and valve-stem packing	U. S. Metallic Packing Co., Philadelphia, Pa.
Rod bushings	National Bearing Metals Corp., St. Louis, Mo.
Power reverse gear	The Baldwin Locomotive Works, Philadelphia, Pa.
Crossheads	Standard Steel Works Co., Burnham, Pa.
Coupler, engine	National Malleable and Steel Castings Co., Cleveland, Ohio
Pedestal shoes	National Bearing Metals Corp., St. Louis, Mo.
Staybolt iron:	
Solid	Ulster Iron Works, Dover, N. J.
Hollow	Joseph T. Ryerson & Son, Inc., Chicago
Staybolts	Flannery Bolt Co., Bridgeville Pa.
Thermic syphons	Locomotive Firebox Co., Chicago
Tubes and flues	(6) Globe Steel Tubes Co., Milwaukee, Wis. (6) Pittsburgh Steel Co., Pittsburgh, Pa.
Superheater	The Superheater Company, New York
Superheater pipes	(6) Globe Steel Tubes Co., Milwaukee, Wis. (6) Pittsburgh Steel Co., Pittsburgh, Pa.
Tangential steam dryer	The Superheater Company, New York
Smokebox netting	The W. S. Tyler Co., Cleveland, Ohio
Smokebox hinges	The Okadee Company, Chicago
Throttle valve	American Throttle Co., New York
Lagging	Johns-Manville Sales Corp., New York
Firebrick	American Arch Co., Inc., New York
Feedwater heater	Worthington Pump and Machinery Corp., Harrison, N. J.
Injectors; injector steam valve; double boiler check valves	Nathan Manufacturing Co., New York
Line check valve for injector	Locomotive Equipment Division of Manning, Maxwell & Moore, Inc., Bridgeport, Conn.
Fuel sprinkler	Nathan Manufacturing Co., New York
Blow-off cocks and mufflers	The Okadee Company, Chicago
Blower valves	Crane Co., Chicago
Blower fittings	Barco Manufacturing Co., Chicago
Washout plugs	Huron Mfg. Co., Detroit, Mich.
Stoker	Standard Stoker Co., Inc., New York
Fire door	Franklin Railway Supply Co., Inc., New York
Clear vision windows and windshield	The Prime Manufacturing Co., Milwaukee, Wis.
Safety valves; steam gages; back-pressure gages; steam-heat gage; cocks and valves	Locomotive Equipment Division of Manning, Maxwell & Moore, Inc., Bridgeport, Conn.
Water gage	Handlan, Inc., St. Louis, Mo.
Water column; water-gage fittings	Nathan Manufacturing Co., New York
Steam-heat regulator	The Leslie Co., Lyndhurst, N. J.
Cylinder cocks; exhaust drain cocks	The Prime Manufacturing Co., Milwaukee, Wis.
Sanders	Morris B. Brewster Company, Chicago
Bell ringer	American Locomotive Co., New York
Headlights and generators	Sunbeam Electric Mfg. Co., Evansville, Ind.
Connections between engine and tender for steam, air and stoker lines	Barco Manufacturing Co., Chicago
Tender:	
Tank steel	United States Steel Subsidiaries, New York
Frames and trucks	General Steel Castings Corp., Eddystone, Pa.
Wheels; springs	Standard Steel Works Co., Burnham, Pa.
Boxes, journal	National Malleable and Steel Castings Co., Cleveland, Ohio
Unit Cylinder clasp brakes	American Steel Foundries, Chicago
Brake shoes	American Brake Shoe & Foundry Co., New York
Coupler	National Malleable and Steel Castings Co., Cleveland, Ohio
Draft gear, A5XB	W. H. Miner, Inc., Chicago
Draft yoke	McConway & Torley Co., Pittsburgh, Pa.
Roller side bearings	A. Stucki Co., Pittsburgh, Pa.
Steam-heat connectors rear of tender	Barco Manufacturing Co., Chicago



The tenders, the first to be carried on eight-wheel trucks, have a water capacity of 24,000 gal. and a coal capacity of 27 tons

Many Innovations Included in

Lightweight Welded Cars

All-welded underframes, ends, doors and roofs feature lightweight cars designed and built by the American Car and Foundry Company

ONE 50-ton steel box car and one 40-ton steel refrigerator car having all-welded underframes, ends, doors and roofs were recently built and tested by the American Car and Foundry Company. The box car is of all-welded construction, while on the refrigerator car the final assembly is by riveting. Low alloy, high tensile, corrosion-resistant steel has been used to the fullest extent practicable in both types of cars, the thickness of the plates and shapes being reduced to a minimum consistent with service and durability. In both cars here described the material is Cor-Ten steel. The principal proportions and weights of these cars, as well as manufacturers' products used in their construction, are included in the tables.

New developments incorporated in the all-welded box car include steel ends with extra-long corrugations, steel doors designed for increased rigidity, and a new design of underframe having an all-welded striker integral with drop-forged front draft lugs, also all-welded combined bolster center filler and rear draft lugs. New developments in the refrigerator car, in addition to steel ends and striker as used on the box car, include the ice bunker, ice hatch, removable steel bulkhead, application of insulation, and a new method of using dry ice in combination with water ice. The bolster center filler in the refrigerator car is a special skeleton design of alloy cast steel.

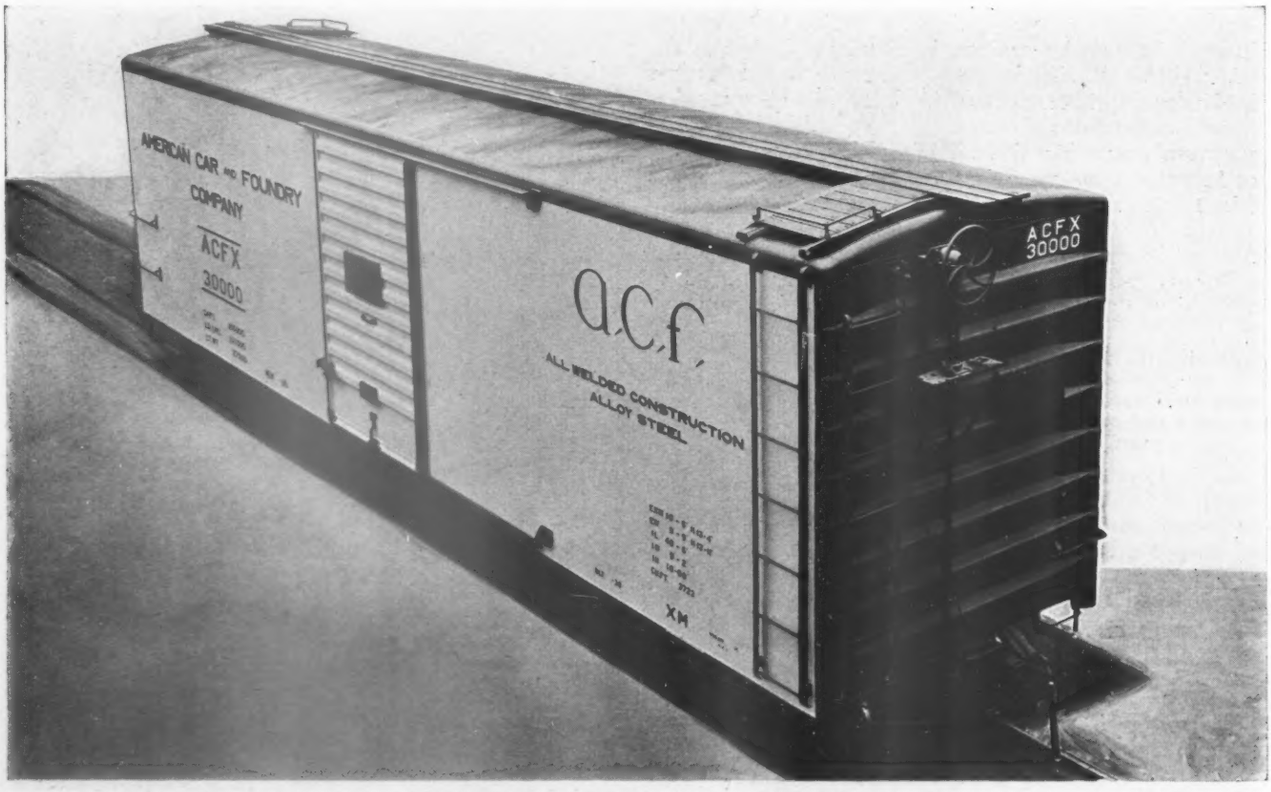
The 50-Ton Box Car

The design of the box car duplicates the 1937 A. A. R. car with respect to inside dimensions, and design strength. However, the new car includes many changes in construction and it has a light weight of 37,500 lb.

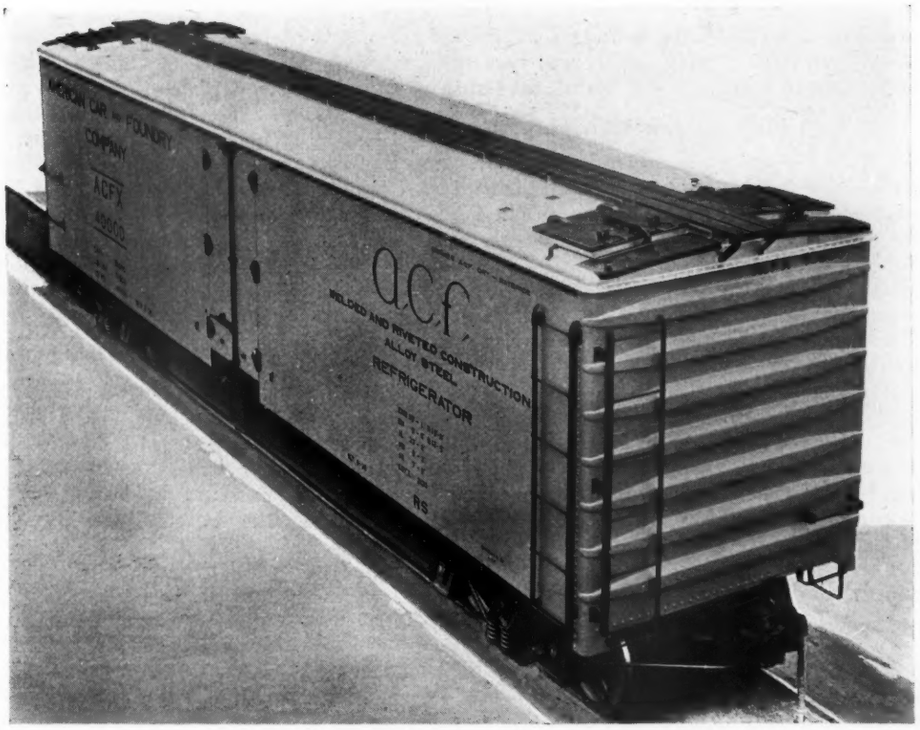
In the design of the box car the structure is divided into a small number of main subassemblies, which are joined into a complete structure by fusion welding; however, the design is such that these subassemblies can be riveted together to form the body if desired. The main subassemblies are as follows: (1) Underframe; (2) sides, including doors; (3) ends; and (4) roof. These four subassemblies are assembled on jigs by both fusion and spot welding, so that when brought together on the assembly track only a small amount of fitting is required.

Each subassembly in turn is made up of several smaller assembled units as follows:

Units of the underframe are (a) the center sills, including strikers, front draft lugs, bolster center fillers, and rear draft lugs, (b) bolsters, (c) crossbearers, and (d) crossties. These units are assembled on welding jigs so as to insure accurate dimensions in the main subassemblies. The center-sill assembly is made up of two A. A. R. Z-section openhearth steel sills (Z-26), with

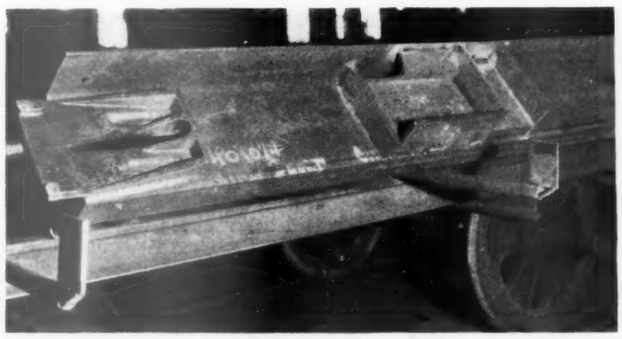


The American Car and Foundry Company welded 50-ton box car, basic features of which are used in the construction of the refrigerator car



Developments in the refrigerator car include the ice bunker, ice hatch, removable steel bulkhead, application of insulation and a new method of using dry ice in combination with water ice

the top flanges welded together from end to end. The cross-sectional area of the sill is 21.3 sq. in. The striker and coupler carrier, including the front draft lugs, are made up of drop forgings and rolled sections welded together and to the center sills. The center-filler and rear-draft-lug unit is built up of low-alloy-steel H-beams and plates all welded together and to the center sills.



The center filler and rear-draft-lug units of the box car are built up of low-alloy steel H-beams and plates all welded together and to the center sills

Each half of the rear draft lug and center-fill construction is first completely welded to its individual sill, and then welded together at the time the two rolled Z-section sill members are welded together.

The body center plate is a steel drop forging with flanges elongated so as to pass under the bottom flanges of the center-sill construction, as well as the body-bolster side member. The center plate is secured to the center sill and bolster construction by a continuous line of welding along the entire length of its flanges. The body center plate thus forms the bottom member of the body bolster construction. The completed center-sill assembly includes separators and a few brake details.

The bolster is made up of two $\frac{5}{16}$-in. U-section pressed plates of low-alloy steel. The bottom of the U-section is the bottom of the bolster. The top member or top cover plate is a 19-in. by $\frac{5}{16}$-in. plate of low-alloy steel welded to the top edges of the U pressings and extending the full width of the car between the side sills. The conventional bottom cover plate is omitted and instead the drop-forged center plate extends outwardly, and is welded to the bottom of the body bolster and bottom flange of the center sills.

Principal Proportions and Weights of the 50-Ton All-Welded Box Car

Length inside, ft. and in.	40-6
Length over striking castings, ft. and in.	41-8½
Truck centers, ft. and in.	30-8½
Width inside, ft. and in.	9-2
Height inside at eaves, ft. and in.	10-0
Height from rails over running board, ft. and in.	14-6¼
Capacity, level full at eaves, cu. ft.	3,723
Light weight, lb.	37,500
Load limit, lb.	131,500
Ratio of pay load to gross load, per cent	77.8
Truck journals, in.	5½ × 10

The bolster pressings are stiffened by braces of low-alloy steel above the side bearing. The side bearing is of high-carbon heat-treated steel riveted to a supporting plate welded to the bottom of the bolster. Pressed-angle stringer supports welded to the bolster complete the assembly.

The crossbearer assembly is also prepared in a jig and consists of $\frac{3}{16}$-in. low-alloy high-tensile steel channels forming a box section. A $\frac{5}{16}$-in. low-alloy high-tensile-steel cover plate is welded to the bottom member of the crossbearers and the center-sill flanges when applied to the sill assembly. Gusset plates of $\frac{5}{16}$-in. low-alloy high-tensile steel connect the crossbearer top member to the center sills.

The crossties are $\frac{1}{8}$-in. low-alloy high-tensile pressed-channel sections forming a support for the floor stringers.

All of these assemblies are provided with brake details which can be conveniently welded in place before the units are applied to the main subassemblies.

The underframe subassembly is completed by assem-

bling the above described units the floor stringers, which are 3-in. 5.1-lb. Z-bars, and end-sill angles all of low-alloy high-tensile steel. The air-brake details are also applied conveniently to the underframe subassembly.

Side Construction Subassembly

The sides are made up of 16-gage low-alloy high-tensile single-pickled sheets spot welded to the framing members, which consist of ⅛-in. pressed Z-section posts, 5/32-in. pressed Z-section corner posts, 3/16-in. pressed angle side sills, 3-in. by 2-in. by 3/16-in. rolled angle side plates, all of low-alloy high-tensile steel. The posts are fusion and spot welded to the side sill and side plates. The transom posts are reinforced by gusset connections to the side sill. The door posts are pressed shapes including spark strips. All of these members are assembled and the side construction completely welded in a jig. The doors are made up of 3/16-in. openhearth-steel pressed stiles and bottom rail, and a 1¾-in. by 1¼-in. by 3/16-in. rolled angle top rail to which is welded a 1/16-in. corrugated low-alloy high-tensile-steel plate made in two pieces spot welded together.

Creco door fixtures are used, including the ball-type support and standard locking device.

Ends

The car ends are made of low-alloy high-tensile-steel sheets provided with special extra-long corrugations, which extend to the end flanges, thereby stiffening them. These ends are built in sections and the sections joined together by fusion welding, the lower half being 5/32 in. and the upper half ⅛ in. The flanges of the car ends are connected to the main body of the end on a curve of approximately 3 in. radius. The corrugations are tapered down and run clear around this curved corner; therefore, stiffening ribs or corrugations extend out into the plane of the anchorage to the side frame. The combination of the round corner with the corrugations extending substantially around this corner gives a pleasing appearance to the corner of the car.

Roof

The roof is the turtle-back type assembled as a unit, having a side-plate angle of 5-in. by 3-in. by 3/16-in. low-alloy high-tensile-steel, with the 5-in. vertical leg formed to a large radius. The roof sheets are of 18-gage low-alloy high-tensile steel, extending from side to side and having a lap joint on every carline. The sheets are spot welded to the side-plate angle, carlines, purlines, and end plates.

The all-welded underframe used on the box and refrigerator cars

The carlines for this roof are of 3/32-in. low-alloy high-tensile steel spaced on 3 ft. 5 in. centers. A Z-shaped purline 2 in. deep and made of 16-gage low-alloy high-tensile steel is applied between the carlines, one on each side of the longitudinal center line of the car.

The roof after being completely assembled is placed on the car body and fusion welded to the car sides and ends, but as stated before, the roof may be attached to car sides and ends by rivets if desired.

Other Details of the Box Car

The doors of this car are bottom hung and are effectively sealed. The spark strips are integral with the door stiles, the top and bottom rails of the door forming the seals. These strips are so designed that increased pressure in closing the door means tighter contact of the surfaces, since the strips are wedge-shaped.

The stiles of the door approach a box section in design and are of 3/16-in. steel. The bottom rail is a special pressed section of 3/16-in. steel whose vertical and horizontal dimensions are 8¼ in. and 2¾ in., respectively. The top rail is a rolled section of 3/16-in. steel. The framework of this door has the strength where it is required, that is, in the two stiles and the bottom rail. However, the door panel has special horizontal corrugations 1⅜-in. in depth extending through the height of the door. This panel is made in two pieces and the assembly is all welded.

The running boards are completely assembled to low-alloy high-tensile-steel saddles before being placed on the car, after which the saddles are fusion welded to roof sheets over each carline and the end supports welded to the end plate.

The end plate is a separate unit made of ⅛-in. low-alloy high-tensile steel formed in one piece, with a large radius formed at the roof line. These end plates are butt-welded to the steel end.

The end sill is made of an integral part of the end construction and consists of a 3½-in. by 3½-in. by 5/16-in. angle of low-alloy high-tensile steel, fusion welded to the steel end.

There are two 3-in. 5.1-lb. Z-bar floor stringer per car, extending from bolster to bolster, fusion welded to underframe cross members and to brackets welded to the bolster web.

The floor support at the side sill is a one-piece 3-in. by 2-in. by 3/16-in. low-alloy high-tensile-steel angle, running the full length of the side sill. It is punched for ½-in. floor bolts. The 2-in. leg is sheared to 1¼-in. and then the angle is spot welded to the side sill.

The car is lined with 25/32-in. by 3¼-in. tongue-and-groove fir, applied horizontally at the sides and vertically at the ends. Side lining is nailed to 2-in. by 2⅞-in. furrings bolted to the side posts, and the end lining is nailed to 3-in. by 3-in. furrings applied in the corrugations of steel ends. These furrings are held in place by ½-in. bolts attached to clips, fusion welded to the steel end.

The ceiling is of ¼-in. plywood applied crosswise of car in one piece from side to side, spliced at each carline. The joint between plywood sections is covered by 18-gage low-alloy high-tensile-steel strips which are attached to the carlines by self-tapping screws.

The floor is of 1¾-in. tongue-and-groove fir laid transversely and secured to floor stringers and floor support on the side sill by ½-in. watertight bolts.

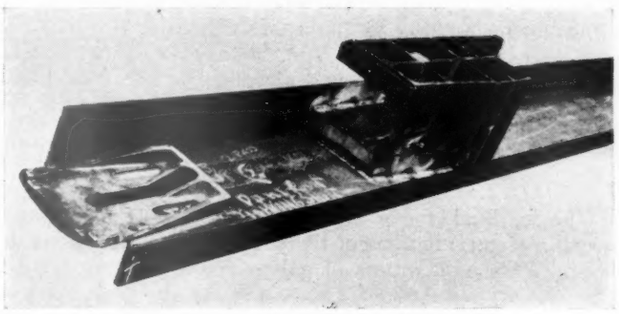
The 5½-in. by 10-in. trucks for this 50-ton box car

have a 5 ft. 6 in. wheelbase and cast-steel double-truss spring-plankless side frames of the integral-box type, furnished by the American Steel Foundries. This company also furnished the cast-steel truck bolsters to which are riveted Stucki roller-type side bearings. The foundation brake rigging includes A. A. R. No. 15 A. S. F. brake beams and Schaefer forged bottom connections and truck levers. The trucks are equipped with Alco top and bottom steel spring plates; Alco A. A. R., 1936, Class D-2 springs and Cardwell-Westinghouse friction-type spring snubbers.

The 40-Ton Refrigerator Car

The steel shell of the refrigerator car is built on the principle of welding subassemblies on jigs, as was described for the box car; however, these subassemblies of the refrigerator car, that is, the underframe, sides, ends and the roof, are assembled by riveting. It is understood, however, that assembly of both the box car and the refrigerator car can be completed by welding or riveting the subassemblies, as desired by the customer.

In general the underframe follows the design used in the box car just described, with the exception that, in



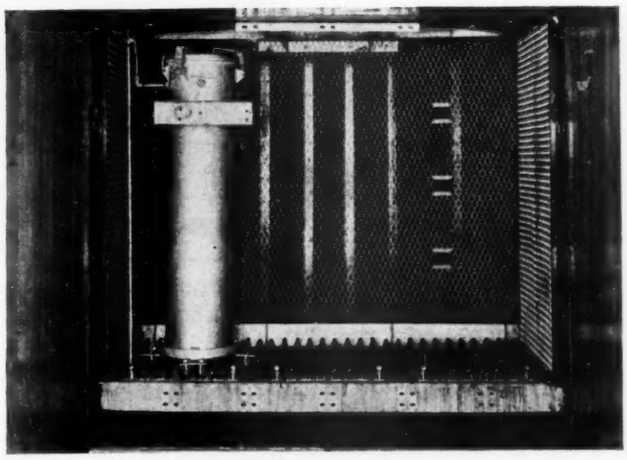
Buckeye combined rear draft lug and center filler castings are used in the center sill of the refrigerator car

the refrigerator car, the combined bolster center filler and rear draft lugs are the Buckeye skeleton type of alloy cast steel instead of being built-up of H-beams and plates as described for the box car. As in the box car, the bolsters, crossbearers and crossties are pressed

Principal Proportions and Weights of the 40-Ton Alloy-Steel Refrigerator Car

Length over corrugations on steel ends, ft. and in.	41- 2⅝
Length inside of lining, ft. and in.	39-10⅞
Length between bulkheads, ft. and in.	33- 2¾
Width inside of lining, ft. and in.	8- 3
Height top of floor covering to ceiling, ft. and in.	7- 9
Height top of floor rack to ceiling, ft. and in.	7- 3
Available cubic capacity between ice bunkers:	
Above floor racks, cu. ft.	1,988
Total, cu. ft.	2,130
Capacity of both ice bunkers, lb.	10,000
Length over end sills, ft. and in.	40- 8⅜
Length over striking castings, ft. and in.	41- 8½
Width over side sills, ft. and in.	9- ½
Width over side sheathing, ft. and in.	9- ⅝
Width over eaves, ft. and in.	9- 4¾
Width, extreme over side ladders, ft. and in.	9- 8½
Distance from center to center of trucks, ft. and in.	30- 8½
Height from top of rail to center line couplers, ft. and in.	2-10½
Height of side door opening, ft and in.	7- 4¼
Width of side door opening, ft. and in.	4
Height from top of rail to eaves, ft. and in.	12- 4 1/16
Height from top of rail to top of running boards, ft. and in.	13
Lightweight of car complete with trucks, lb.	44,200
Truck journals, in.	5 × 9

and rolled low-alloy high-tensile-steel sections of all-welded construction. The side construction of the refrigerator cars is also the same as that described for the box cars with the exception that 4-in. by 3-in. by



Dry-ice container in the ice bunker

¼-in. rolled angle side sills are used. The doors of the refrigerator car are made up of ⅛-in. pressed-angle stiles and rails to which are welded 16-gage door sheets; Miner lightweight door fixtures are used.

The ends of the refrigerator car are of the builders' corrugated type developed for the box car. The sides of the car ends are flanged to a 3-in. radius and are riveted to the ends of the steel side sheathing.

The roof of the refrigerator car is of the same turtle-back design and construction described for the box car, with the exception that the carlines are spaced on 3 ft. 4 in., instead of 3 ft. 5 in. centers. The running boards are of the same design used on the box car.

The refrigerator car is equipped with Barber Stabilized trucks, Type S-2, with cast-steel double-truss spring-plankless side frames of the integral-box type, furnished by the Buckeye Steel Castings Co. This company also furnished the cast-steel truck bolsters to which are riveted Stucki roller-type side bearings. The only modification in the side frames for these Barber Stabilized trucks is a recess of ⅜-in. in the columns to permit the application of ⅜ in. spring-steel wear plates, after the application of which the side frame conforms to A. A. R. interchange requirements. The ends of the bolsters are changed to provide pockets for the Barber friction castings. Increased spring capacity is provided by this stabilizer because of frictional build-up between the friction castings and wear plate, which also prevents springs going solid. The trucks are also equipped with top and bottom steel spring plates and A. A. R., 1936, Class C-2 outside coil springs furnished by Alco. The foundation brake rigging includes A. A. R. No. 15 Creco brake beams and Schaefer forged bottom connections and truck levers.

Refrigerator-Car Insulation

The bottom course of insulation applied on the ⅝-in. blind floor is a 2-in. blanket of Fiberglas faced with muslin, and covers the full width and length of the car in one piece. The top course of insulation is in panel form of 2-in. Fiberglas covered on both sides with Sisalkraft paper and fits snugly between the floor nailers.

In this car one side and end is insulated with Johns-Manville Stonefelt and the other side and end with Fiberglas furnished by Gustin-Bacon. The sides and ends are insulated with two courses of 2-in. Stonefelt or Fiberglas applied in panel form. Panels are made up of a Celotex backing to which the Stonefelt or Fiberglas is cemented; this construction enables repairs to be made to the steel sides in case of necessity without

removing the side lining. By applying the lining vertically, the boards at the damaged panel need only be removed.

The roof insulation consists of an upper course of 2-in. Stonefelt in blanket form and a lower course of 2½ in. in panel form. This is made up of Johns-Manville Stonefelt and Celotex.

The insulation for the side door consists of two courses of 2-in. Fiberglas muslin covered in panel form.

Partial List of Materials and Equipment on the a. c. f. 50-Ton Box and 40-Ton Refrigerator Cars

BOX CARS

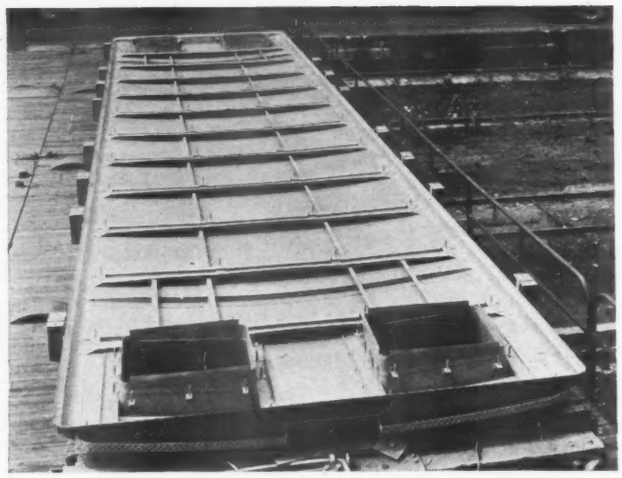
Underframe and superstructure steel, Cor-Ten	Carnegie-Illinois Steel Company, Pittsburgh, Pa.
Side frames; truck bolsters	American Steel Foundries, Chicago
Bottom connections; truck levers	Schaefer Equipment Company, Pittsburgh, Pa.
Side bearings	A. Stucki Co., Pittsburgh, Pa.
Hand brakes; wheels	American Car and Foundry Company, New York
Springs; spring plates; journal-box lids	American Locomotive Co., Railway Steel Spring Div., New York
Axles	Carnegie-Illinois Steel Corp., Pittsburgh, Pa.
Journal bearings	National Bearing Metal Corp., St. Louis, Mo.
Couplers; coupler yokes	Buckeye Steel Castings Company, Columbus, Ohio
Uncoupling device	Union Metal Products Company, Chicago
Draft gear; spring snubbers	Cardwell Westinghouse Company, Chicago
Air brakes	Westinghouse Air Brake Co., Wilmerding, Pa.
Brake shoes	American Brake Shoe & Foundry Co., New York
Brake beams	American Steel Foundries, Chicago
Side door fixtures	Chicago Railway Equipment Co., Chicago
Defect card holder	MacLean-Fogg Lock Nut Co., Chicago

REFRIGERATOR CAR

Underframe and superstructure steel, Cor-Ten	Carnegie-Illinois Steel Company, Pittsburgh, Pa.
Side frames; truck bolsters	Buckeye Steel Castings Company, Columbus, Ohio
Hand brakes; wheels	American Car and Foundry Company, New York
Axles	Carnegie-Illinois Steel Corp., Pittsburgh, Pa.
Springs; spring plates; journal-box lids	American Locomotive Co., Railway Steel Spring Div., New York
Journal bearings	National Bearing Metal Corp., St. Louis, Mo.
Couplers	Gould Coupler Corp., Depew, N. Y.
Coupler yokes	Buckeye Steel Castings Company, Columbus, Ohio
Uncoupling device	Union Metal Products Co., Chicago
Draft gear	W. H. Miner, Inc., Chicago
Bottom connections; truck levers; wear plates	Schaefer Equipment Company, Pittsburgh, Pa.
Stabilizers	Standard Car Truck Co., Chicago
Center filler and rear draft lug	Buckeye Steel Castings Company, Columbus, Ohio
Air brakes	New York Air Brake Co., New York
Brake beams	Chicago Railway Equipment Co., Chicago
Brake shoes	American Brake Shoe & Foundry Co., New York
Side bearings	A. Stucki Co., Pittsburgh, Pa.
Door fixtures	W. H. Miner, Inc., Chicago
Side-door threshold; waterproof floor	Johns-Manville Sales Corp., New York
Door packing	American Car and Foundry Company, New York
Insulation:	
Stonefelt	Johns-Manville Sales Corp., New York
Fiberglas	Gustin-Bacon Mfg. Co., Kansas City, Mo.
Board panels	Celotex Corporation, Chicago
Hatch covers	Alan Wood Steel Co., Conshohocken, Pa.
Bunker wire (Consolidated Expanded Metal Co.)	Wheeling Steel Corp., Wheeling, W. Va.
Defect card holders	MacLean-Fogg Lock Nut Co., Chicago

The hatch plug is insulated with two courses of 2-in. Stonefelt.

The inside lining consists of $^{25}/_{32}$-in. by 3¼-in. tongue-and-groove fir applied vertically on sides and ends. The side lining is nailed to 1⅝-in. by 2½-in. yellow-pine horizontal furrings bolted to side posts; the end lining is nailed to 1⅝-in. by 2½-in. yellow-pine horizontal furrings bolted to clips, fusion welded to the steel car end.



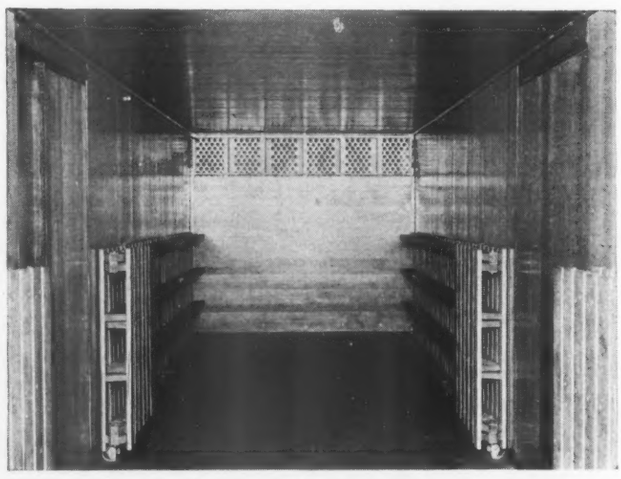
Welded turtle-back roof inverted to show structural details

The ceiling is formed of $^{25}/_{32}$-in. by 3¼-in. tongue-and-grooved fir applied transversely of the car and nailed to 2⅜-in. by 2½-in. yellow-pine roof purlines bolted to clips, fusion welded to the roof carlines.

The floor consists of 1¼-in. by $5^{1}/_{16}$-in. tongue-and-groove fir laid transversely and spiked to the floor nailers. Over this floor is applied Johns-Manville membrane flooring.

The Ice Bunkers

The ice bunkers, of builder's design, have floor pans which are continuations of the Johns-Manville membrane floor. Perfection drains of galvanized steel, and a.c.f.



The refrigerator car interior

well traps of galvanized pressed steel are used. The ice-grate support is built-up of pressed low-alloy high-tensile-steel sections fusion welded together to form a single unit. The ice-grate support is carried on shelves at the side of the car, which are a part of the car framing. There are three ice-grate sections in each bunker, which sections are built-up of ⅛-in. inverted-V pressed grate bars fusion welded to $^{3}/_{16}$-in. grate-bar ties. These sections are bolted to the supports and are removable.

The bulkhead unit is made up in three sections—two side and one center section—each completely finished be-

(*Continued on page 475.*)

The Evolution of

The Locomotive in France

By Lawford H. Fry

A review of La Locomotive á Vapeur* by André Chapelon†. This book contains 914 pages and 14 folding plates

IT seems eminently proper to say that Mr. Chapelon's "La Locomotive á Vapeur" (The Steam Locomotive) is a monumental work. Its size alone, 900 pages, 9 in. by 11 in., weight 10 lb. avoirdupois, would justify the adjective. In addition, the text is a very valuable contribution to our organized knowledge of the locomotive. The chapters describing recent improvements in the Paris-Orleans-Midi locomotives and the thermodynamic foundation for these changes should be required reading for every American locomotive designer. As assistant chief engineer of design of equipment of the Paris-Orleans-Midi Railway, Mr. Chapelon has taken an active part in the design of many of the remarkable locomotives he describes, and provides full documentation for the theories on which the designs are based.

The book is essentially an account of the development of the steam locomotive in the last thirty years. The various types which have been used in Europe and America are described and illustrated and general dimensions are given. Other chapters deal at considerable length with the basic thermodynamic conditions which control the operation of the steam locomotive. In the present writer's opinion this is the most valuable part of the book. Details of construction receive very little attention, and except for the descriptions and dimensions of the various types, Mr. Chapelon is concerned with the physiology of the locomotive rather than with its anatomy.

To show the scope of the book, the titles of the nine sections of the book are quoted. The number of pages given for each section will serve to indicate the emphasis the author places on each phase of his subject:

		Pages
I	Introduction	10
II	Recent Evolution of the Steam Locomotive	290
III	Thermal and Thermodynamic Studies of the Steam Locomotive	435
IV	Dynamics of the Steam Locomotive	40
V	Power and Tractive Force of the Steam Locomotive	45
VI	Testing the Steam Locomotive	30
VII	Operation of Steam Locomotives	15
VIII	The Design of Steam Locomotives	30
IX	Conclusion (Results at Present and Possibilities of the Future)	3

In the introduction the evolution of the locomotive in France is sketched briefly with photographs to scale showing the progress from Marc Seguin's 4.5-ton 25-hp. locomotive of 1828 to the Paris-Orleans 103-ton Pacific type of 3,700 hp. in 1934. Mr. Chapelon points out that the important thing is not the growth in size, but the growth in power per unit of weight. This is, of course, due to perfection of details giving greater efficiency in steam production and consumption. In French practice an increase is noted from 21 hp. per ton in 1900 to 23 hp. per ton in 1910 and 25.4 hp. per ton in 1931. At this point a great further step was made. The Paris-Orleans after thorough scientific study of the problem undertook the rejuvenation of their four-cylinder Pacific type locomotive. By increasing the superheat, applying an improved exhaust nozzle and front end, and by doubling the cross-sectional area of the steam passages in the low pressure cylinders, the indicated cylinder horsepower was increased from 2,200 to 3,700, this 50 per cent increase being obtained with less than 11 tons increase in weight. The horsepower per ton was increased from 23 to 37, a truly remarkable jump.

Mr. Chapelon took an active part in the development work of these P-O-M locomotives, and a large and important part of the present book is devoted to describing the principles and designs which produced such phenomenal efficiency. As to the guiding idea, we quote in slightly abbreviated form Mr. Chapelon's words:

> What are the deep causes of progress? Real progress requires more than a mere increase in size. Improvement is indissolubly tied to efficiency. The second law of thermodynamics is of the first importance in that science. In developing it, Carnot was not interested in producing the most powerful heat engine. He aimed at producing the most efficient no matter how small the power.
>
> Progress can only be made on a basis of exact knowledge, knowledge which can only be acquired by untiring experiment. In the present case it is easy to show that all the decisive progress has resulted from methodical tests which have been made with the locomotives. That eminent scientist, Henry Le Chatelier, pointed out recently that many working in the hard school of realities become discouraged, lose faith in Science, and turn toward some easy solution, forget how real progress is impeded by acceptance of an easy empirical solution of their problem. In the ancient profession of railroad engineering there is, perhaps, too great a tendency to follow tradition and to be skeptical of science, thus neglecting opportunities for rejuvenation. All should join in a crusade for Science, as this alone will develop the spirit and forge the tools necessary for effective and rapid progress.

Mr. Chapelon speaks warmly and in a good cause. We in America may well consider his views seriously. The steam locomotive cannot develop if we attempt to force new designs into the frame of the old ratios.

The second section is largely given over to pictures or diagrams of recent locomotives of all countries and of all types. Two hundred and twenty-five locomotives built in England, Europe, and America are shown and principal dimensions are given. This section is interesting as showing the diversity of opinions or tastes which guide locomotive designers. It is worth noting that in presenting boiler dimensions only boiler pressure and grate area are given. Mr. Chapelon points out that the power of a locomotive depends in the first place on the rate at which heat can be produced in the firebox, and that for a given fuel and a given thickness of fire this rate of heat production is proportional to the grate area. This is true enough, and for locomotives all burning the same coal the grate area measures the boiler capacity better than the area of heating surface does. However, the locomotives compared range from the English engines burning first class full coking steam

* Published by J. B. Bailliere et Fils, 19, Rue Hautefeuille, Paris, 6e, France. Price, 125 francs.

† Mr. Chapelon is assistant chief engineer of design of equipment of the Paris-Orleans-Midi Railway.

coal to western American engines burning a friable semi-lignite, and under such conditions the grate area alone does not give a true measure of the boiler capacity.

Principles Underlying Recent Evolution

In discussing the principles which underlie the evolution of the steam locomotive in the last thirty years, Mr. Chapelon notes the following tendencies:

Boiler Pressure

In 1907 compound locomotives were working with 225 lb. per sq. in., while superheater locomotives were, through imperfect understanding of the thermodynamics of the situation, using only 170 to 200 lb. per sq. in. Gradually these pressures have increased. In Germany pressures of 285 lb. per sq. in. are now used for single expansions and of 355 lb. per sq. in. for compounds. In France a pressure of 285 lb. per sq. in. is commonly used. In America pressures have been increased somewhat more slowly, but have risen to 250 and, in many recent cases, 300 lb. per sq. in. Mr. Chapelon warns, however, that the use of a high boiler pressure calls for a number of precautions that do not seem to have received sufficient attention. With such pressures the effect of the cylinder walls and leakage may easily take such proportions as to wipe out any gain.

To realize the efficiency made available by high steam pressure, it is essential to use a very high superheat and possibly reheating. At the same time a high degree of expansion must be used, with compounding or triple or even quadruple expansion cylinders. Steam jacketing of the cylinders may also be desirable.

Superheat

Thirty years ago the merits of superheat were still under discussion, with strikingly successful results being reported from Germany. Superheating is now general practice, but the increase in steam temperature has not been continuous. The early German locomotives with short tubes worked ordinarily with temperatures of about 600 deg. F. rising occasionally to 675 deg. F. As the Pacific and Mikado types with their longer tubes were introduced, steam temperatures dropped. The consequent loss of efficiency led to study of the situation. Dimensions were improved and various novel designs of superheaters were tried. At present a minimum steam temperature of 700 deg. F. is aimed at and in some cases temperatures of 750 deg. F. or even 800 deg. F. are desired. The last figure is that for the German State compound with 355 lb. per sq. in. boiler pressure. Mr. Chapelon expresses the opinion that extremely high steam temperatures present no difficulty so far as the boiler is concerned, but require special cylinder lubricants and special cast iron for cylinders and piston rings. Looking to the future he concludes that for a pressure of 285 lb. per sq. in. a temperature of 750 deg. F. is insufficient. Several railroads are experimenting with reheating of the steam between the high and low pressure compound cylinders.

Compounding

The expansion of the steam is discussed at considerable length. It is pointed out that in America single expansion cylinders are used exclusively, but that in Europe compounding is coming back into favor, particularly in France where it was widely used twenty years ago.

Mr. Chapelon is a strong advocate of compounding, because of the greater efficiency. Quoting the results obtained with the rebuilt Paris-Orleans engine for express service, he shows that the highest speeds can be reached provided that the steam passages for the low-pressure cylinders are given sufficient cross-sectional area.

Steam Distribution

Valve motions are discussed briefly, Mr. Chapelon being of the opinion that almost any system will give good results if the piston rings and valve bushings are in good condition. He feels that the effect that can be produced by changing the valve motion to vary the valve events is purely secondary. Cylinder efficiency depends essentially on ample cross-sectional area being provided in the exhaust passages in the cylinders.

A similar line of reasoning is applied to poppet valves. Their advantage does not lie in a more rapid opening or closing of the ports. As advantages can be claimed: (1) Elimination of the necessity for lubricating the steam distributors at high steam temperatures; (2) Poppet valves provide ample steam passages with low inertia effects. In the Paris-Orleans four-cylinder compound with low-pressure cylinders 25.5 in. in diameter with very large steam passages, the moving parts of the poppet valves weigh only about 10 lb. and have a lift of only 1-⅛ in. The reduction in inertia forces in comparison with a piston valve is obvious.

Recent Improvements in French Locomotives

Following very brief notice of boilers, superheaters, and running gear the Section on the recent evolution of the steam locomotive gives a somewhat detailed account of the improvements in exhaust, superheat, and steam passages which were applied to the rebuilt Paris-Orleans locomotives. This chapter and the Section on Thermodynamics which presents the theory justifying the changes in the rebuilt engine provide the real meat of the book. They tell a story which is of sufficient importance to claim a separate chapter of this review. The claim that the indicated horsepower was increased from 2,200 to 3,700 with an increase in weight of only 11 tons is startling, but it is so documented with test data as to be entirely convincing. Details are reserved for comment in a later issue.

Dynamics of the Steam Locomotive

The chapter on the Dynamics of the locomotive provides an interesting survey of the subject. A point of interest is the statement, attributed to Mr. Loewy of the Southwestern Railway of Russia, in 1893, that in a two-cylinder locomotive the forces set up in the frames by the cylinder thrust are not the same on both sides. Mr. Chapelon gives an example showing that with 84-in. cylinder centers and 42-in. frame centers the frame stresses on the side of the leading crank are about 15 per cent greater than the stresses in the frame on the other side.

In discussing counterbalancing of locomotives, the statement is made that longitudinal balance is comparatively unimportant. In support the experience of the German State Railways is quoted. Recently, in order to reduce dynamic augment the balance provided for the reciprocating parts was greatly reduced. As a result the riding of the locomotive was improved.

The external dynamics of the locomotive are dealt with, trackage on tangent and curves being discussed. In the chapter on Power and Useful Tractive Force, train and locomotive resistance are discussed and some of the many resistance formulae are quoted. As a result of many experiments on the road and on the testing plant, it is concluded that in spite of its machinery, a locomotive running light with throttle open has a rolling resistance not noticeably greater than that of a similar

weight of train, and that this resistance is practically unaffected by the number of axles which are coupled.

To provide information as to the loads that a locomotive can handle, attention is given to the limitations on locomotive power that are set by adhesion and by boiler capacity. It is pointed out that for high-speed service it is of the greatest importance to have a high value for the ratio of cylinder horsepower to total weight.

The Sections on the Testing and the Operation of Steam Locomotives are of interest without any very deep study of the subjects.

Thirty-two Horsepower per Ton of Locomotive

The final Section on Design presents designs for several types of locomotives in which the experimental data and the theories developed have been used to produce locomotives of maximum power and of the highest efficiency. Two of the most interesting types are a 4-6-4 to handle 870 tons at 100 miles per hour and a 2-10-4 to handle 4,900 tons at 68 miles per hour. Both engines have the same boiler and are designed to develop 6,000 hp. in the cylinders with a grate area of 75 sq. ft. and total engine weights of 350,000 and 357,000 lb. in working order. These figures represent 80 i. hp. per square foot of grate and 32 hp. per ton of locomotive and are 20 to 25 per cent better than current American practice. They might be considered excessively optimistic if they were not supported by detailed information as to results being obtained today on the French railroads. Starting ten years ago with efficiencies comparable with those of present day American practice, the French are shown by Mr. Chapelon to have studied the subject very closely and then to have obtained in practice the increased efficiency which theory showed to be possible. Important features of design contributing to high efficiency are: ample steam passages from boiler to exhaust; double stack with special exhaust providing high draft with low back pressure; and super-heater giving high steam temperatures with low pressure drop. Improvement of design along these lines seems to be possible for America, and Mr. Chapelon's work may be found to have an important message for American locomotive engineers.

It is hoped to present in an early issue a more detailed review of the theory and practice which have been followed in the recent development of the French locomotives, will be presented in an early issue.

Lightweight Welded Cars

(*Continued from page 472*)

fore placing in the car. The bulkhead header brace is composed of pressed alloy-steel sections fusion welded together—all metal parts are galvanized, while the sides. end walls, and the back of the wood bulkhead are coated with car cement and treated with asphalt-treated felt. The removable wood bulkhead is built-up on a single unit of 1⅛-in. by 5⅛-in. tongue-and-groove fir, framed together with galvanized pressed channels at the sides. The end and sides of the icebox are faced with Steelcrete 1¼-in. Cop-R-Loy bunker mesh. A 4-in. by 4-in. mesh of 0.035-in. diameter galvanized wire screen is provided at the top opening of the bulkhead.

Other Features of the Refrigerator Car

There is one dry-ice container in each bunker at diagonally opposite corners of the car. Each container, of the builder's design, has a capacity of 300 lb., and is so designed that CO_2 gas can be exhausted either into the car or the atmosphere, depending on the character of the lading.

One of the illustrations shows the general arrangement of the container and piping. The container proper consists of an outer cylindrical galvanized steel shell with gas-tight removable charging cover equipped with suitable gasket. An inner shell of square cross-section is placed inside of the outer shell. This square shell is closed at the bottom and open at the top. The dry-ice blocks (a maximum of six 50-lb. blocks) are placed in this inner shell.

The CO_2 gas resulting from the sublimation of the dry ice flows over the open top of the inner shell and fills the space between the outer and the inner shells, thereby helping to insulate the dry ice by means of its own gas. As the gas pressure within the container builds up to slightly less than 1 lb. per sq. in., the check valve in the exhaust pipe lifts and allows the gas to exhaust either into the car proper or to the outside air, depending on the setting of the three-way cock in the exhaust pipe.

The container can be applied to old as well as to new cars as it is inserted through the hatch and rests on the ice grate. In the combination of dry ice and water ice in ice bunkers as developed by the American Car and Foundry Company, tests show a lower uniform temperature to be obtained with less consumption of water ice so that the cost of both dry ice and water ice is lower than the cost of water ice alone as used in a conventional ice bunker. The tests, of course, were conducted under the same condition. The use of this device is optional with the purchaser of the car.

The floor rack, of 1¾-in. by 4⅞-in. fir rails and 1⅛-in. by 4-in. yellow-pine slats, is held in place by hinges which permit raising the rack when cleaning the car. Exposed metal parts are galvanized.

The car is equipped with double-swinging doors which provide a 4-ft. opening. Miner door fixtures and La-Flare packing are used. The doors are also fitted with striking plates and hooks for holding the door open, and with Johns-Manville threshold plates.

The hatch plate and cover, which is of builder's design, has a flexible connection between the cover and the plug, providing sufficient leverage to break the ice seal around the plug. One ice hatch is located at each corner of the car. The hatch cover is of Super Diamond plate, flanged on all sides. The cover and plug can be set in the ventilating position by means of a ventilating bar.

Improved Barber Truck

The original Barber stabilized truck, described in the *Railway Mechanical Engineer* for March, 1934, and known as the Type S-1, was designed by the Standard Car Truck Company, Chicago, to promote easy riding and overcome costly harmonic spring action. This design required a special type of side frame but used the standard design of truck bolsters which were provided with roller pockets when Barber lateral-motion device was desired and several thousand cars using this truck are now in service.

Subsequently, a new design of stabilized truck, known as the Type S-2, was developed and while it did not permit the use of a lateral-motion device, it did enable the use of standard A.A.R. or double-truss types of side frame and with only a slight change in the ends of the truck bolsters. With this improved design, shown

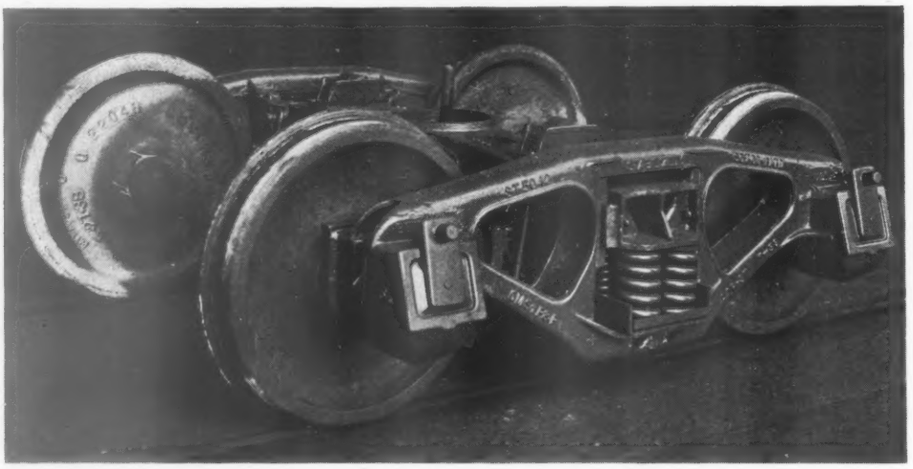
in the schematic drawing, the only modification in the side frame is a recess of ⅜ in. in the columns to permit the application of ⅜-in. spring steel wear plates and after these wear plates are applied, the side frame conforms strictly to A.A.R. standards.

The slight change necessary in the ends of the bolsters is to provide pockets to receive the friction castings. These castings are of special alloy friction iron and each has an area of 36 sq. in., giving a combined area of 72 sq. in. per frame of contact with the column wear plates. This results in an extremely low pressure per square inch and provides the means of breaking up the truck spring oscillations by the control of the bouncing action. It also means an easy riding car, thereby reducing damage claims to a minimum and reduces car maintenance expense. Increased spring capacity is also provided when most needed because of the frictional build-up between the friction casting and wear plate, therefore, the springs do not go solid and cause spring breakage.

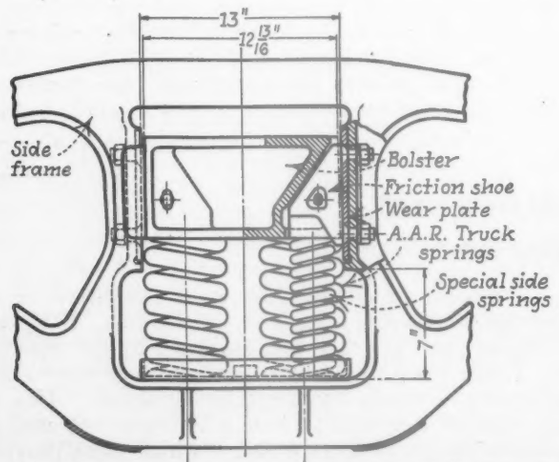
One of the outstanding features of this truck is the elimination of the customary wear on bolsters and side-frame columns and because of its unique construction it eliminates all looseness between these members.

This truck also provides for the use of standard A.A.R. truck coil springs but saves the furnishing of eight inner coils; the manufacturer supplies eight springs of slightly higher capacity than standard inner coils and each of these springs supports a friction casting. These springs are slightly longer than the truck springs but made with the same solid height and, due to this extra length, there is said always to be sufficient compression to retain the friction block in tight contact with the bolster and column wear plate. This extra length of side springs also provides a means for taking up automatically, any slight wear that may develop on friction castings due to years of service. With this truck it may also be said that only four spring plates per car are required and these can be either the universal or plain non-patented type, manufactured by either the railroad or the car builder.

Still another outstanding advantage claimed for this truck is the graduated pressure exerted between the friction block and wear plate, dependent upon the load in the car. Purdue tests show that, with an empty car or, in other words, with only the weight of the car body, the pressure between the friction block and wear plate is approximately 20 lb. per sq. in., which increases in proportion to the load. The maximum pressure under a fully loaded car amounts to 65 lb. per sq. in. of frictional area. This design tends to provide for easy or smooth riding, regardless of the amount of load in the car.



Improved Barber Type S-2 stabilized truck which is designed to cushion vertical shocks in proportion to the load



Schematic arrangement of parts for Barber stabilized truck

CAR MEN MARK 50TH ANNIVERSARY.—The Brotherhood Railway Carmen of America this month is commemorating the 50th anniversary of the organization of its predecessor union, the Brotherhood of Railway Car Repairers of North America, at Cedar Rapids, Iowa, October 28, 1888. According to the current issue of the "Railway Carmen's Journal," seven car repairers met in an unused combination baggage and smoking car of the Burlington, Cedar Rapids & Northern (Chicago, Rock Island & Pacific) on that date and formed the first lodge. The present organization was formed in September, 1890, by the union of the original organization and the Carmen's Mutual Aid Association. Highlights of the preamble and declaration of members of the union which were adopted at the first convention at Topeka, Kansas, included the following aims of the brotherhood; "first, to exalt the character and increase the efficiency of carmen, to bring greater proficiency into their department by a mutual interchange of ideas and a discussion of the best and most economical methods of performing labor; second, to benefit our employers by raising the standard of our craft; third, to establish mutual confidence and create and maintain harmonious relations between employer and employee; fourth, to care for our dear ones in distress or when disabled or removed by accident or unavoidable adversity."

EDITORIALS

One Effect Of Seniority

In these days of reduced forces and short working hours supervisors are faced with many problems in their struggle to keep up with the minimum demands that must be satisfied if rolling stock is to continue to operate safely. One of the annoying conditions with which they must deal is the constant shifting of men as forces are expanded or reduced. No sooner have men become familiar with the duties of their assignments than they are "bumped" or laid off.

Not only is this annoying; it is a wasteful and, in some respects, hazardous. Let it be admitted that most of the mechanics, particularly those in the enginehouse, have had an all-around training. Nevertheless, when assigned to trouble shooting on some particular parts of the locomotive and its appurtenances, time, coaching and study are required before an expert degree of proficiency can be developed. Where this proficiency is lacking work reports may be repeated many times before the real seat of the trouble is located.

Thus is caused an unfortunate waste of effort at the very time when man-power resources are already inadequate. Another unfortunate aspect is the bearing such a condition may have on the development of disastrous locomotive failures, such as the crown-sheet failures referred to in these columns last month.

Continuous Training

"We have only recently begun to . . . realize that the real task of education is not to bring children to the last grade of the common school, or even to carry them through high school. We have come to learn that even the enormous expansion of the number of our children who will actually obtain the benefits of university education is not enough. The real educational problem is to provide that the whole of our people shall throughout their lives be able to carry on the education which is automatically lifelong, with the assistance of skilled teachers and proper facilities." Thus spoke Sir Edward Beatty, chairman and president of the Canadian Pacific Railway, at the Triennial International Transportation Conference of the Y. M. C. A. of North America, recently held in Toronto.

The remarkable growth of the adult education movement in recent years is probably due to two factors. In the first place, shorter working hours have made it possible for more and more adults to attend the evening classes and to profit from them either in broader culture or greater skill in their occupations. Of still greater importance, however, is the fact that the introduction and development of new products, new materials and new methods of fabrication, has called for better training and more expert knowledge on the part of the supervisors and workers in all industries. Labor-saving machinery in accounting and office work, for instance, has in many cases replaced slow and tedious processes; at the same time it has required a different sort of training and ability to handle these new devices.

The railroads in this country have never recognized the importance of the continuous education and training of their employees to the same extent as have the railroads abroad. Even the training of shop apprentices, except on a very few roads, has been a more or less haphazard process and little if any systematic attention has been given to the training of the workers after they have become journeymen. Is this not a serious mistake, and ought not special attention be given to Sir Edward Beatty's challenge by the heads of all the departments of our railroads, and particularly by the mechanical department?

The past few years, in spite of the depression, will stand out in the history of the railroad mechanical department because of the introduction of new materials, of new designs of equipment, and of improved machinery and equipment available for maintenance and repair processes. How much attention is given to training the supervisors and the workers in the use and operation of these new products and machines, which in many instances differ radically from those which they are superseding—and we are only just at the beginning of a far more widespread use of such things. Certainly the younger men, or those in middle age, should be given the opportunity to increase their knowledge and improve their abilities to deal with these improvements.

And how about the men who have passed middle age? Are they to be thrown on the scrap heap, as some of them now are, or be allowed to work inefficiently because of lack of training, a reasonable amount of which will enable them to improve their production and give satisfactory service? One of the most pathetic experiences that one can have is to run across men in good physical condition, whose spirit is broken because their jobs have outgrown them. What greater service could a labor union render its members than to assist in finding ways and means of arranging for continuous training for the workers throughout their service life? Railroad managements undoubtedly will benefit greatly by assisting their employees to maintain their working efficiency at a reasonable high standard. Possibly the public school system and other agencies, which

have already set up adult training courses, can in some way co-operate in the technical training required by railroad workers. Certainly some of the Railroad Y. M. C. A. secretaries who were inspired by Sir Edward's discussion of adult education, will be glad to do what they can to co-operate in this respect.

Time To Pull Together

The wage controversy is over. However discouraging to the managements the conditions which caused them to withdraw the wage reduction may be, they have, by that act, removed a cause of serious demoralization in the relations between employees and managements.

Whatever opinion one may hold as to the merits of the case of the railroads for the proposed wage reduction—we believe it was a good case—one cannot but regard the situation of the employees with sympathy, particularly those in the shops, enginehouses and repair tracks. To face a reduction of personal income is always disturbing. In the face of the utmost uncertainty as to the number of hours per month one may be permitted to work or, indeed, as to the permanency of any job at all, the prospect of a wage reduction becomes sufficiently desperate to give subversive leadership an opportunity to do its worst in destroying all bases for understanding between management and men.

In withdrawing the wage reduction the railroads were led to hope that both government and the labor organizations would cooperate actively in developing a constructive program of legislation to mitigate some of the current difficulties of the industry. The future alone can disclose how well justified this hope may be. The utmost skepticism as to the outcome of this organized cooperation, however, should not blind one to the very real possibility of restoring an atmosphere of confidence and cooperation between each individual employee and his particular management. Let it be the purpose, first, of every management and every supervisor, and then of every man in the ranks to restore such an atmosphere.

As long as men expect to make their careers and their living on the railroads they have a stake in the welfare of the industry greater in the aggregate than that of the bondholders or the stockholders. In 1929, the last year of pre-depression prosperity, the aggregate compensation of employees of the Class I railways amounted to 46 per cent of total operating revenues; in 1933, the year in which aggregate wage and salary payments were the lowest, they still amounted to 45.5 per cent of total operating revenues, although in amount they were less than half the payments of 1929. In 1937, partly as the result of wage increases, employees received a slightly increased proportion of total operating revenues—47.5 per cent. Still the total amount was 31 per cent less than in 1929 because total operating revenues were 33.5 per cent less. Bond and note holders, who received in interest 8 per cent of total operating revenues in 1929, received more money in 1933—16.6 per cent of total operating revenues—and less money in 1937, although the 11.5 per cent of total operating revenues was still proportionately high. Dividends, which took almost 8 per cent of total operating revenues in 1929, were reduced in amount to less than 20 per cent as much in 1933, were still but about 40 per cent as large in 1937, and took but four per cent of the total operating revenues of that year.

Certainly these facts point to the vital interest of employees in the general welfare of the railway industry. No amount of struggle for a redistribution of the operating revenues can compensate for the adverse effect on the welfare of employees as a whole of a continued decline in revenues. Furthermore, those employees who resent the amount paid out by the railroads as interest on debt should observe that only by a return of prosperity to the industry can the amount thus disbursed be reduced. The highest interest payments during the depression were in 1933 when the curtailment of employment was at its worst. Unbalanced budgets on the railroads, just as in government or in the household, led to increased debt and increased the drag of interest payments.

But how can employees influence the prosperity of the railways? Through a restored fighting morale permeating the entire organization. There was a time, when railways were a transportation monopoly, that morale meant little in increasing the business of the railroads as a whole, although it might mean much in competition between railroads. Now, with subsidized transportation agencies in strong competition with the railroads, it is vital to the future of the entire railroad industry that it be on its toes to cut costs and improve service if it is not to see a continued reduction of its proportion of the total transportation business of the country, with an accompanying loss of opportunity for employment in its service.

With the immediate cause of demoralization removed every supervisor who believes in his job will, in his own self interest, do everything in his power to restore a fighting morale throughout the organization of which he is a part. Then will the hope which led the managements to withdraw the wage reductions, at least in part, be justified.

The Railroads and The Apprentice Problem

One of the railroad programs which has been most neglected during the depression period since 1929 is that of apprentice training. Upon a gradual return to normality, with adjustments in maintenance practice necessitated by improvements in motive power and

rolling stock, and in the equipment required for their maintenance, as well as by improved practices in shop operation learned during periods of economic stress, the question arises as to what attitude the railroads are going to assume toward the training of apprentices. There is no doubt but that this problem is one of the easiest to side step. Although many railroad officers in the past and at present have approached the subject with a friendly attitude, there have been many others who blindly refused to believe that such training is of benefit both to the apprentice and the railroad and that it can be conducted without great trouble and expense.

Some railroads, which prior to 1929 maintained an apprentice system comparable to the best of those found in other industries, have taken no steps to rebuild it to its former high standard. This is true notwithstanding the fact that many of their best mechanics are their own apprentice-trained men. The present trend in shop practice encourages the development of specialists rather than all-around skilled mechanics; this has been one of the factors working against the restoration of apprentice training to its former high standard. This fact, in addition to others, such as expenses involved in training men who may ultimately resign after being trained, and the cost of apprentice supervision and schools has undoubtedly had its influence in retarding the interest in apprentices which was growing steadily before the beginning of the depression.

If the railroads wish to maintain a high standard of workmanship in their shops and to have the services of men with a deep personal interest in the railroad's maintenance problems, they must take a more forward looking attitude toward the training of men not only as mechanics but also as future supervisors and administrative officers. More today than ever before there is a crying need for trained men with exceptional abilities in these capacities. A well-rounded apprentice training program is one of the best means of attracting such men into the ranks and starting them on the road to meet these higher responsibilities.

The principles of a sound apprentice system are well set forth by Warner Seely, of the Warner & Swasey Company, Cleveland, Ohio "Execution of the actual training program," he says, "presupposes a careful analysis of shop training opportunities available for the gradual development of skill; a thorough understanding of related subject matter which trainees will have to learn to meet the needs of the particular employer; and a recognition of the need for training in broader social and economic fields, without which proper balance cannot be insured. Given a proper understanding of all these elements, it is possible to establish an all-embracing program, with standards fixed to maintain fundamental requirements but allowing flexibility enough to accommodate individual capacities, unusual skills, and particular interests. Such standardization does not mean regimentation in any sense. It merely insures performance by trainees at a level which accomplishes the training objective and returns a quantity of productive work sufficient to support and immediately justify the program."

The railroads as well as other industries cannot shirk their obligation to train and develop young men for a productive and a useful life. This in no way infers that such an obligation is being side stepped, but merely that perhaps it is not realized to its fullest extent. Although public schools and governmental agencies are increasing the scope of their activities in the field of industrial training, industry itself should take the initiative and organize its own internal training programs. Many industries other than railroads have in recent years made tremendous advances in the training of carefully selected men who manifest superior mental qualities and manual skill, thereby striving toward a more intelligent mobilization of the capacities of the men they select to train. By the law of averages, such carefully selected men will yield some who will advance beyond the specialties of skilled mechanics and develop the capacity for leadership.

Many of our railroads are still maintaining apprentice systems in some form or other; however, some of them are apprentice systems in name only. They have no predetermined or rigid schedule of work which is so necessary if adequately skilled mechanics with a well-rounded-out shop experience are to be turned out. Others, while making some effort toward systematic routing of apprentices through the various departments of the shops, have no school or other instructional facilities. There are truly no half-way measures. Real apprentice training requires high standards of shop experience, education and supervision.

New Books

STRUCTURAL ALUMINUM.—*Published by the Aluminum Company of America, Pittsburgh, Pa. 5½ in. by 8 in.; imitation-leather bound. Price, $1.25.*

Progress in the manufacture of aluminum alloy structural products and in the design and fabrication of structures employing these products is reflected in this second edition of the Aluminum Company's handbook on structural aluminum. The book presents fundamental information regarding the ultimate strength of structural members fabricated from aluminum alloys, based on laboratory investigation, field tests and extensive practical experience. A section containing commercial sizes, tolerances and specifications has been added; the tables of elements of sections for structural shapes have been expended, and values for torsional constants, with notations on the present availability of sections, have also been added. Elements of sections for rectangular shapes and for tubes have been included and arranged to facilitate computation. The calculations involved in the preparation of the book are based upon theoretical cross sections as shown in the tables.

THE READER'S PAGE

Piston Rod Failures

To the Editor:

In connection with the interesting remarks on Piston Rods and Crossheads, by "Foreman" in your January issue, (page 13) and Frank Rattek in the June number, page 225, it is noticeable that both gentlemen attribute failures to what may be called poor quality of fits. This is true, and a liberal use of the hammer will not overcome an initial poor fit, either in the taper end of the rod, or in the key.

Many crossheads, particularly of older engines, have the taper socket bored right through, and the rod is specified to have a definite amount of "draw" which the key is supposed to take up. With such construction the stresses induced may be anything, but will certainly be of increasing order every time the key has to be tightened.

The British fitting practice appears to have definite advantages; the taper socket of the crosshead has a carefully machined shoulder at the small end. The key slot is milled out undersize, in both rod and crosshead. The rod is then pressed in until the small end "bottoms" against the shoulder in the crosshead socket, at a definite specified pressure. The key slot is then broached out to finished size, with a reciprocating broach somewhat narrower than the rough machined slot. The key is then fitted in solid.

I have before me a drawing of a piston rod for 19-inch cylinders of the three-cylinder Pacifics of the London and North Eastern; the taper of the rod is $\frac{5}{64}$ inch per inch diameter and the taper of the key 1 in 30. The fit calls for the rod to be pressed up solid at the bottom of the socket with pressure of 50 tons, the key slot broached out in place, and the key fitted solid. With a known initial holding force, which in this particular case is nearly twice the maximum piston thrust, the key would appear to be relieved somewhat from load, and having a bearing throughout its length will have better holding power, without excessive use of the hammer.

H. J. Coventry.

Poor Workmanship the Cause of Many Failures

To the Editor:

F. H. Williams' articles on the service failure of locomotive parts are, to say the least, interesting and informative, especially when he calls attention to the fact that improper fits resulting from poor workmanship are the causes of many such failures. However, the writer would like to call attention to the fact that improper workmanship cannot always be recognized as such, and the mechanic will insist that his work cannot be better and in this opinion will be backed up by his supervisor. In support of this statement the writer gives the following three examples of many which could be quoted.

A few years ago we were encountering an excessive number of service failures of piston rods, the failure occurring at the large end of the crosshead taper fit. Supervisors and mechanics alike insisted that failure was due to poor materials although those being used were the best that money could buy and conformed to chemical and physical properties established by our test department. Upon investigation, the mechanic on the job and his supervisor pointed with great pride to the method employed in making the fits. The crosshead was being drilled and presumably tapered ¾ in. per ft. on a vertical boring mill, after which the large diameter of the hole was calipered and the taper on the piston rod machined ¾ in. per ft. from this measurement. More care on this job could not be taken, we were told by both the mechanic and his supervisor, but upon investigation it was shown that there was no fit whatever and instead the bearing occurred only at the large end of the proposed fit. Reamers with a taper of ¾ in. per ft. were purchased and used for making the crosshead fit, and the old procedure of calipering the large diameter of the hole was followed. Service failures ceased to occur after adoption of this practice.

Another instance involves the tapping of staybolt holes in side sheets. We had been obtaining upward of two years' service from such sheets when suddenly their service life fell to an average of three months, the cause of which was laid to poor materials, although again in this case better quality materials had been purchased. Investigation showed that new staybolt taps, purchased at approximately the same time that the new sheet material had been specified, were without lead, and were being used because improved quality of the tap material gave a vast improvement in the number of holes tapped per redressing of the tool. This same tap material used in a tap with lead, retained the tap efficiency and returned the life of the sheets to that obtained before the introduction of the short no-lead tap. Here again, mechanics and supervisors insisted that poor sheet material and not improper workmanship caused our troubles.

One day not long ago we received a hurried call from a division point asking that new driving-box grease be purchased immediately to avoid tieing up the railroad. It seems that power just out of the shop was running hot, the crown brass freezing to the journal. A representative of the grease company called at the shop the following day and found the crown brasses being turned with 0.001 in. tolerance, and was told that such tolerance was correct by the mechanic on the job. The mechanic was astounded to be told, and shown in turn, that the drawing called for 0.001 in. tolerance per inch of journal diameter.

These examples are not to be taken as criticisms of work done in railroad shops, but merely as a suggestion that when failures do occur it might be well to investigate thoroughly the practices of machining or fabricating the part in question.

S. M. P.

Worn-Through Chill Spots Detected by Color

To the Editor:

In your December 1937 issue, "Informal Discussion of Car Questions," I noted the question as to how a worn-through spot could be recognized. The answer was a reference to the wheel and axle manual which is correct of course. There is another way to identify the above defect which seems to me to be as effective and that is to note the color of the iron in a worn-through chill spot. It is a dull gray of a coarser texture than the chill of the wheel.

I wonder how many foremen and inspectors use this method?

Smith W. Dobson.

With the Car Foremen and Inspectors

Fig. 1—Riveting a coal-car side with a Hanna portable riveter at the Decatur steel-car shop of the Wabash

Decatur Shop Devices

A number of shop devices which greatly expedite work at the Wabash freight-car shops, Decatur, Ill., are shown in a series of six illustrations accompanying this article. At present, along with other work, a series of 55-ton twin-hopper coal cars is being given extensive repairs and rebuilding at this shop at a rate of four cars a day. As reconstructed, these cars will have practically all new copper-bearing steel bodies applied on the original underframes, center sills and body bolsters. Murphy panel sides are being installed. The trucks also have new cast-steel side frames.

At the station where car sides are assembled and fabricated by riveting, as shown in Fig. 1, a riveting pit is provided, equipped with a powerful pressure riveting machine. The depth of the pit is not sufficient, however, to permit applying the top row of rivets on 7-ft. high coal car sides, and to use the stationary riveter mentioned would necessitate suspending the car side upside-down from the overhead trolley in order to bring the row of rivets at a level with the riveting head. To avoid

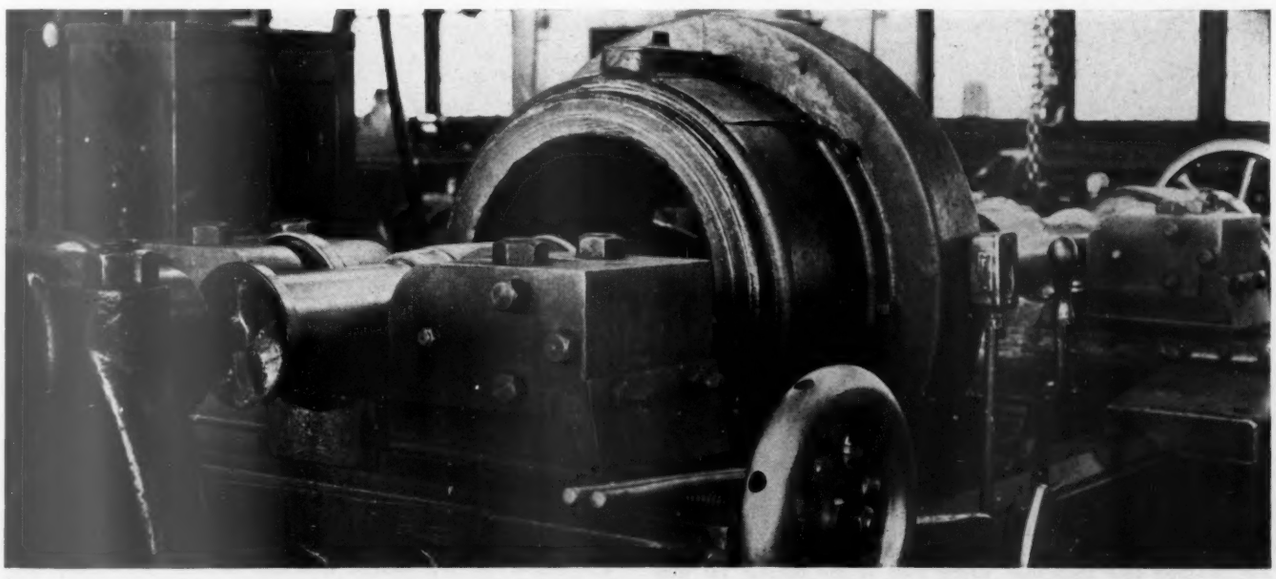


Fig. 2—Heavy-duty journal-burnishing lathe equipped with large double-acting rolls to relieve the lathe centers

this rather awkward handling and time consumed in reversing the car sides, a Hanna portable pinch-bug riveter is supported from the overhead trolley, as illustrated, for applying the rivets to the stationary car side which rests on the bottom of the riveting pit, thus bringing the top of the car side at the proper height above the shop floor for the convenience of men who are performing the riveting operation. The pressed-steel side panels used in constructing these car sides are shown in the foreground of the illustration.

In Fig. 2 is shown an unusually satisfactory machine set-up for rolling car journals. The old center-drive axle lathe has in effect been rebuilt into a journal-burnishing machine which does an exceptionally good job in a minimum time. The two single-post tool carriages, applied on the original machine, were removed and replaced by new carriages equipped with large double rolls. Each of the two new carriages is made from a steel casting, machined at the local shop and fitted for application to the lathe. The rugged character of this carriage and its contained parts is well shown in the illustration. The rolls are 7 in. in diameter by 1¼ in. thick, being supported in roller bearings of substantial size. Powerful hand cross feed of the rolls towards each other is provided by a right-and-left feed screw turned by the heavy hand wheel with handle extension. The machine is started and stopped by the conventional electric push-button control, and a quick throw-out friction clutch, operated by a handle at the right, disconnects the longitudinal feed when the rolls have reached the journal fillet.

Car journals, machined at the Wabash wheel-and-axle shop, are first given a light, smooth finishing cut and then rolled on this machine, which finishes both journals on an axle simultaneously and does an unusually accurate and satisfactory job. One of the most important advantages of this double-roll design is that heavy roll pressures may be used without over-heating or distorting the lathe centers.

The draft-gear wagon, shown in Fig. 3, is successfully used at the Wabash shops when dropping draft gears for inspection or whenever it is necessary to remove and reapply them. The wagon consists of a well braced welded steel framework, approximately 36 in. long by 15 in. wide by 20 in. high, which is suitably mounted on three truck wheels. The main wheels at the right are 18 in. in diameter and the 7 in. swiveling front wheel is mounted on an axle pin connected to the wagon handle. The base plate on this steel framework is carried about one inch from the shop floor and supports an ordinary car jack which is used in lowering and raising the coupler yoke and draft gear. As a matter of fact, this draft-gear wagon is equipped with all of the tools necessary in applying draft gears, including hammers, wrenches, wood blocks, various sizes of cotter keys, pinch bar, etc.

The great advantage of the device is that a coupler yoke and draft gear can be loaded on it at any point wherever convenient in the shop, readily moved to the car and pushed in position under the center sill with a minimum of hand labor. The jack also moves with the wagon and does not have to be pushed or pulled about by shop men bent over in a cramped position. In the interests of safety, it is important to block the wagon wheels and use reasonable care in raising or lowering the draft gear, otherwise a painful accident may occur.

Fig. 3—Draft-gear application wagon used at the Decatur car shop of the Wabash

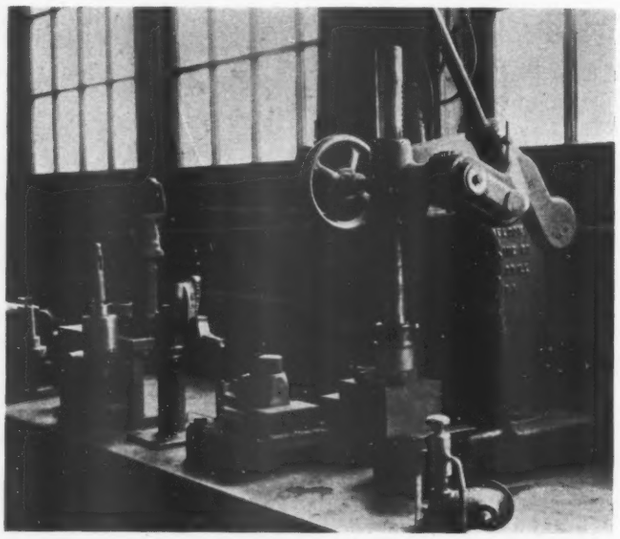


Fig. 4—Special tools and devices used in reconditioning Vapor 2-in. steam-heat connectors

This rather simple hand-operated device is considered superior to some of the pneumatic draft gear-application devices which frequently have sufficient power, with a light car frame, to lift it from the supporting horses and thus introduce a potential hazard.

Several special tools and devices used in the reconditioning of Vapor 2-in. steam-heat connections have been developed, as illustrated. Upper joint bodies are renewed where necessary, new bushings applied in all parts and joints refaced to assure freedom from subsequent leaks. Referring to Fig. 4, there is illustrated, from right to left, a shop-made gage for testing the height of the bearing, a small hand-press used in applying bushings, a special jig for knocking the bearings out of clamps, a master gage for checking the head wear, and a drill-press jig for refacing the joints of various bearings, when worn. This jig is more clearly shown, together with some completed connectors, in Fig. 5.

The drill-press jig is in effect a 6-in. steel channel drilled on the top flange and the side to accommodate the various tops of the steam-heat connector which must

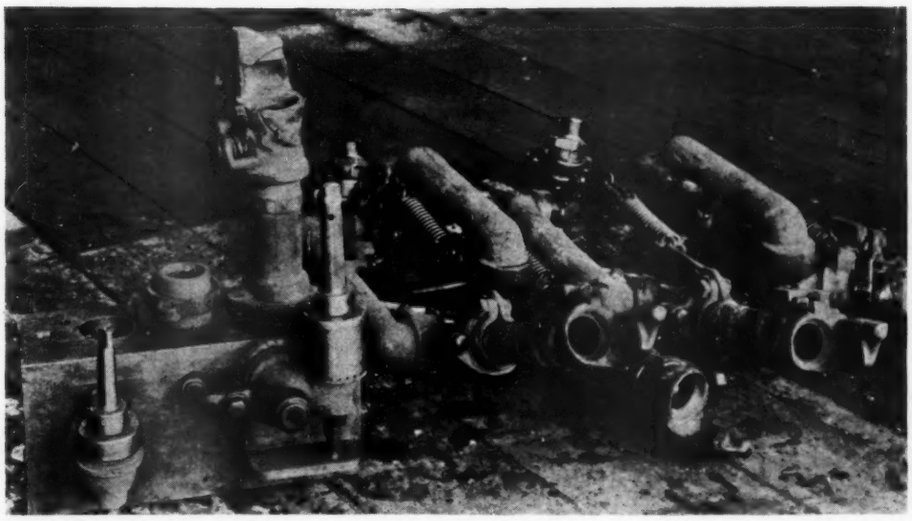


Fig. 5—The drill jig and some reconditioned connectors

be refaced. Standard box reamers and cutters can then be used in the drill press spindle to reface these parts quickly and accurately ready for re-assembly and the application of new bushings.

In cutting stencils for Wabash car equipment at the Decatur shops, the machine shown in Fig. 6, is used to good advantage. This machine, known as a Cutawl K-9 size, is furnished by the International Register Com-

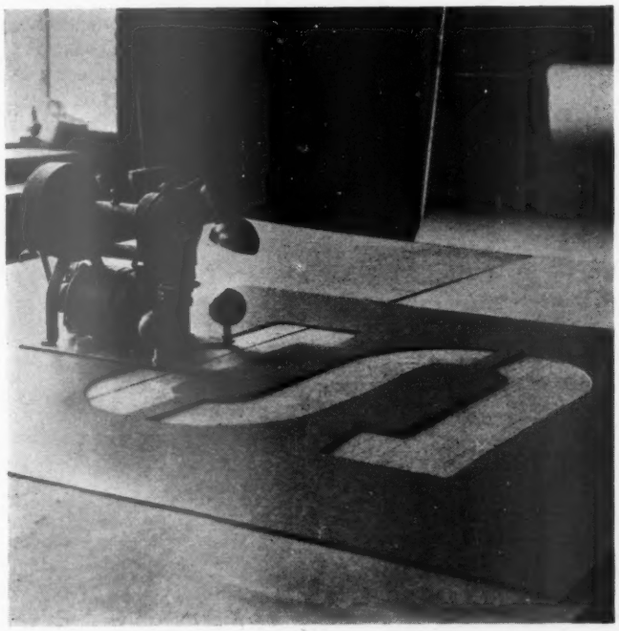


Fig. 6—Modern electrically operated stencil-cutting machine which is both fast and accurate

pany, Chicago. Electrically operated on 110-volt current, this machine can be equipped with various kinds of cutting chisels and saws which operate vertically at a speed of 3,200 oscillations per minute to cut thin copper, galvanized sheets, fibre and many other materials. The particular advantage of the tool is that it can be hand operated by sliding across the table with the chisel following accurately any desired line, whether straight or curved and practically regardless of how short the radius may be.

In cutting stencils with No. 1 red stencil paper it is possible to cut five thicknesses at one time. This permits manufacturing standard stencils in quantity and at minimum cost at one point for the entire system.

Decisions of Arbitration Cases

(The Arbitration Committee of the A. A. R. Mechanical Division is called upon to render decisions on a large number of questions and controversies which are submitted from time to time. As these matters are of interest not only to railroad officers but also to car inspectors and others, the Railway Mechanical Engineer will print abstracts of decisions as rendered.)

Labor Charges Claimed Excessive And Repairs Claims Unauthorized

On April 26, 1935, a Florida East Coast car was damaged to the extent of Rule 44 while being switched on the Clinchfield. The car was interchanged to the Chesapeake & Ohio where it was transferred and returned empty on May 24 to the Clinchfield, which latter road made repairs to the car and returned it to service on May 29, 1935. The car was received at its home line on July 4, 1935, and on September 18, the owner submitted a joint inspection certificate which claimed that the car arrived home in an extensively damaged condition. The owner requested a defect card from the Clinchfield to cover the damages, but the latter furnished a defect card to cover only a part of the items. The owner made repairs to the car on December 9, 1936, and submitted a bill to the Clinchfield on authority of the previously mentioned defect card.

The Clinchfield maintained that the car was not in the condition reported in the joint inspection certificate when it left its line, and took exception to the charge as rendered, contending that certain charges were excessive and that some items had been billed that were not covered by the defect card, which was issued under protest to cover wrong-repair items which were listed in the joint inspection certificate. The Clinchfield pointed out that after it had made repairs to the car in question, the car had moved consecutively from the C. C. & O. to the C. & W. C., from the C. & W. C. to the Southern, from the Southern to the Pennsylvania, from the Pennsylvania to the Southern and from the Southern to its home line.

The Clinchfield maintained that if the car were damaged to the extent maintained in the joint inspection certificate it could not have been moved in interchange on the roads just mentioned; therefore, it maintained that the repairs made by the F. E. C. were not justified on the basis of the defect card issued and the charges made therefor were excessive.

The F. E. C. showed that the Clinchfield had no record of the damage sustained at the time of the accident, and pointed out that the Clinchfield made repairs during a five-day period, one of which was a Sunday, and that before and after repairs were made the car had to be moved a total of 273 miles. The owner maintained that the work in question could not have been done during the five-day period. The owner also produced evidence showing that the car was received on the home line in the same condition reported by the C. & O. when first moved from the Clinchfield after the accident in question. The owner also produced a record of man-hours actually involved in repairing the car and contended that the charges therefor were not excessive.

In rendering a decision on November 11, 1937, the Arbitration Committee stated: "The Clinchfield should issue its defect card to cover all items shown on the joint inspection certificate dated August 30, 1935, and, since the charges contained in the repair bill rendered by the F. E. C. are based on actual time and A. A. R. allowances for repairing the damage so covered, the bill should be paid as rendered."—*Case No. 1,761, Clinchfield versus Florida East Coast.*

Multiple Die for Small Steel Car Parts

This article describes a special device used in the punching of small steel car parts. The outstanding feature is that all holes in a part may be punched at one time, yet the high cost associated with conventional die construction is not incurred. The device was originally set up for the production of the parts illustrated in Fig. 1. Its conversion for the production of other parts is rapid and inexpensive.

The device consists essentially of special holders for standard punches and dies, and two base plates, one bolted to the bed of the punching machine and the other to the slide. The holders are made with threaded shanks

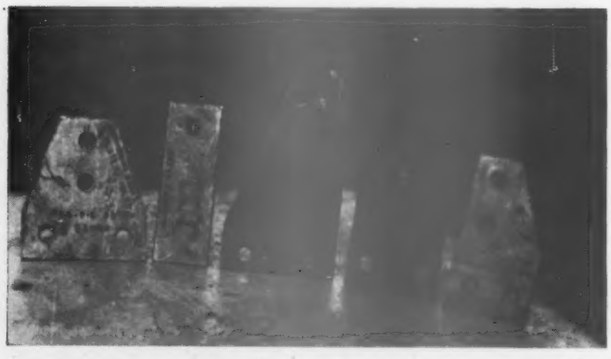


Fig. 1—Plates punched with dies shown in Figs. 2 and 3

so that they may be secured by screwing into appropriately located, tapped holes in the base plates. Both the holders and the base plates are made of ordinary steel; thus, from a material standpoint, they are initially inexpensive. The holders are permanent parts of the equipment and are not discarded unless they are broken or in some other way become damaged. The base plates, on which there is a minimum of machine work, are simple to make and are only replaced at long intervals.

The base plates in this setup were made of steel 2 in.

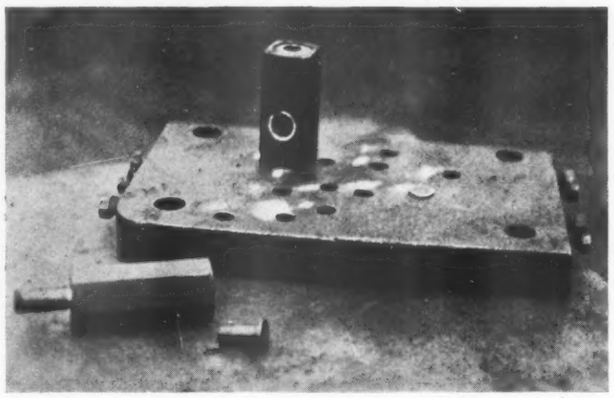


Fig. 2—Base plate which is fastened to the machine bed, with a die holder screwed in position

thick. Holes for securing the punch and die holders are drilled and tapped into these plates in exactly the same arrangement as are the holes in the parts which are to be punched. Figs. 2 and 3, which illustrate these base plates, indicate the many jobs which may be set up on a single set of plates. All of the five parts shown in Fig. 1 are punched by the use of these two bases. As may be noted from Figs. 2 and 3, there is still considerable space available for making setups for other jobs. The limiting conditioning of serviceability is reached when there is no further space available for the locating

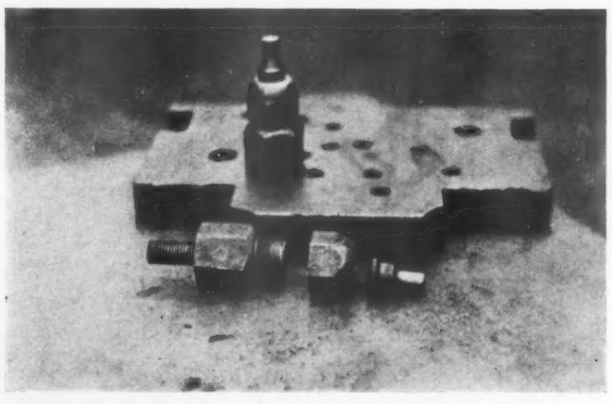


Fig. 3—Punch-holding base plate which is fastened to the machine slide

of additional holes. This time may be extended by the judicious use of one or more holes from a previous setup when laying out for a new job. When using conventional dies it is customary to scrap them after the job is completed, or at best store them for future use. As the only parts disposed of in this device are the two base plates, the saving is immediately apparent.

Fig. 2 shows the base plate which is fastened to the bed of the machine with a die holder screwed into position. Another die holder lying in the foreground shows the threaded shank used for securing the holder to the base plate. The holder is arranged to take a standard die of 1-¾ in. outside diameter, and provides for shedding

the punching slug from a side hole. The hole from which the slug is emitted is outlined in white on the die holder which is screwed to the base plate. A sectional view of the holder is given in Fig. 7. The shank of the holder is 1-⅞ in. long and is threaded with a standard ¾-in. bolt thread. The height of the die holder is governed by the dimensions of the machine to which the

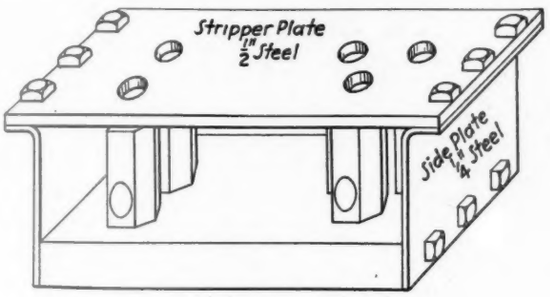


Fig. 4—Stripping arrangement

device is applied. When it is desired to punch square or other noncircular holes, a set-screw is installed near the top of the die holder in such a position as to engage the side of the die. This arrangement prevents the die from turning after it has been correctly located. It has been found advantageous to stencil each hole in the base plate with a number; the template for each part to be punched is then stenciled with numbers corresponding to the holes in the base plates which give the proper die arrangement. While this numbering is not essential, it facilitates rapid setting-up and change-over from one job to another. This arrangement is of particular value when there is a considerable period of time between two runs on the same part.

Fig. 3 shows the punch-holding base plate which is fastened to the slide of the machine. A punch holder is shown screwed into place. In the foreground is a dis-

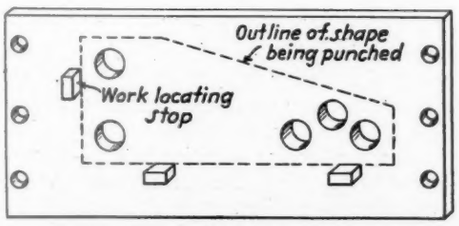


Fig. 5—Bottom side of the stripper plate

assembled holder showing the threaded shank, the nut for securing the punch to the holder, and a standard punch. The shank of the punch holder is made to the same dimensions as that of the die holder. The length of the holder is determined by the dimensions of the machine and the height selected for the die holder. The length is made so that the punch penetrates about ⅛ in. into the die when the machine is at the lowest point of its stroke. In order to distribute the load thrown on the machine by the punching of several holes at one time, it has been found advantageous to use punches of different lengths in a setup.

Several large holes will be noticed in the base plates shown in Figs. 2 and 3. These are used for attaching the plates to the slide and bed of the punching machine. The best procedure in the making of these plates is to clamp them together and drill the holes for the punch and die holders while the plates are thus clamped. This insures exact alignment of the punches and dies without any unnecessary shifting after the plates are mounted.

Several bolts will be noticed on the short sides of the base plate shown in Fig. 2. These are used to attach a stripping device to hold the work down while the punches are withdrawing. Two types of strippers are used depending on the type of work being done. When it is necessary to maintain the edge distance accurately and the production is in large quantities, a stripper is used of the general design shown in Figs. 4 and 5. Locating stops are welded to the bottom surface of the stripper plate. It is generally sufficient to use three such stops for the effective locating of the parts to be punched, as illustrated in Fig. 5. The side plates of the stripping arrangement, shown in Fig. 4, are permanent parts of the equipment. It is only necessary to renew the stripper plate when changing over from one job to another.

When it is not necessary to maintain accurate edge distance, or when the production is comparatively small, a stripper made of ½-in. by 2-in. bar iron, is shown in Fig. 6, is used. Two lengths of this type of stripper are

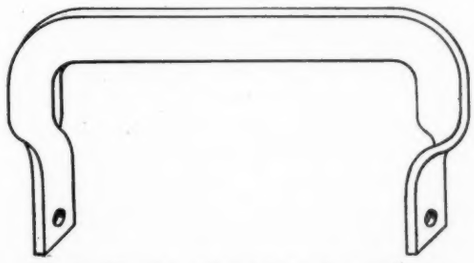


Fig. 6—Alternate stripper design for small runs

provided. The longer ones fit across the base plate from one end to the other in the same general manner as the stripper previously described and shown in Fig. 4. The shorter ones fit across the base plate from back to front. Either type is used, depending upon the job being done. It is sufficient for practically all purposes to use two such strippers. When this type of stripper is used the part

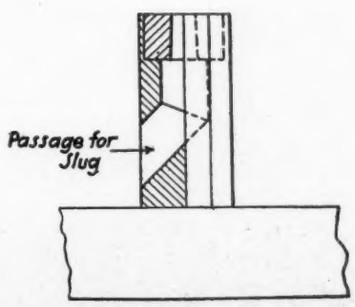


Fig. 7—Section through the die holder

to be punched is located visually, generally with the aid of marks chalked on the stripper.

When punching holes smaller than ¾-in. diameter, there is a possibility of the slug falling into one of the unused die-holder holes in the base plate. Under certain conditions it is difficult to remove these slugs from the holes without taking the base plate off of the machine. Since one of the features of the device is that the base plates need not be removed every time it is desired to change-over from one job to another, plugs of the type shown in the foreground in Fig. 2 are dropped into the unused holes in the base plate; such a plug is also shown in one of the die-holder holes of the base plate. The plugs may be made advantageously by cutting down the head of a ½-in. by 1-½-in. rivet. In set-

ting up the device it is necessary to make certain that the slug-shedding hole in the die holder is not blocked by an adjacent holder. The holder must be in such a position that there is ample space for the slug to fall out.

In the event that such space is not available after setting up, the following procedure is recommended: A washer, made of some light-gage material, is placed around the threaded shank of the die holder so that when the holder is screwed down it will be a portion of a turn back from its position when no washer is present. By the use of one or two such washers it is always possible to locate the die holder appropriately for the shedding of slugs.

This device permits all of the accuracy, speed, and other advantages usually associated with die operation to be obtained, yet does not require the customary large expenditure for regular die construction.

Applying Hand Brakes

At the Dupo, Ill., car repair tracks of the Missouri Pacific, a fairly extensive program of applying modern hand brakes is being carried out and for this purpose the special wood scaffold and template, illustrated, are

Scaffold and template used in laying out bolt holes and applying hand brakes

used to good advantage. This scaffold is 9 ft. 8 in. high and has an 8-ft. top plank 2¼ in. thick by 16 in. wide. The corner posts are 2-in. by 3-in. material, well braced and spaced at the bottom approximately 6 ft. by 12 ft. Suitable ladder rungs on each side give easy access to the top of the scaffold.

Just back of the scaffold and leaning against the car end, is a special template made of light ½-in. by 2-in. wood strips and arranged so it can be used to indicate the accurate positions of all bolt holes used in the application of any particular type of hand brake and brake step. This template not only reduces the time required in laying out the bolt holes but assures their standard correct location.

Questions and Answers On the AB Brake

Brake Cylinders (Continued)

354—*Q.—What should be the approximate time of blow down?* A.—In from 40 to 65 sec.

355—*Q.—With the retaining valve in the low-pressure position, what should be the blow-down rate?* A.—From 40 to 15 lb. in 30 to 55 sec.

356—*Q.—If the blow-down rate were correct in high-pressure position, would it be necessary to repeat the test for the low-pressure position?* A.—No.

357—*Q.—In the event that the valve fails on high-pressure position but is satisfactory in low-pressure position, what may be the trouble?* A.—The trouble would be in the choke between high- and low-pressure positions.

358—*Q.—What is the proper opening for this choke?* A.—A No. 67 drill opening.

359—*Q.—What is the size of the blow-down port in the cap nut?* A.—A No. 54 drill opening.

360—*Q.—What precaution should be taken before making a blow-down test?* A.—All leakage should be reduced to within the limits specified for cylinder, retaining valve and pipe leakage.

361—*Q.—What will cause a blow at the quick-service exhaust in the release position?* A.—Leaking graduating valve, service slide valve, or service portion cover gasket.

362—*Q.—What will cause a blow at the brake-cylinder exhaust port in release position?* A.—Leakage past the service slide valve, service portion gasket, emergency portion gasket, emergency slide valve, or emergency portion cover gasket.

363—*Q.—What will cause a blow at the emergency portion exhaust in release position?* A.—Leakage past the vent valve, the emergency graduating valve, the emergency slide valve or the emergency portion cover gasket.

364—*Q.—What will cause a blow at the quick-service exhaust in the service lap position?* A.—Leakage past the release insuring valve, the service slide valve or the service portion cover gasket.

Compound for Steam Or Vapor Cleaning

The Magnus Chemical Company, Inc., Garwood, N. J., recently placed on the market a product known as "Magnus Vapor Cleaner" which was developed to increase the effectiveness and speed of steam or vapor cleaning by combining the principles of soap washing with solvent cleaning. This combination was made to obtain the two results faster and to effect more thorough "cutting" action than when either is used alone.

This product is offered in two grades: Magnus 92-E for light-duty cleaning and Magnus 94-E for heavy-duty cleaning. Both are light-brown pastes which are soluble in water. They impart to the water a wetting, penetrative and solvent effect said to be superior to that of any soap or alkali. The cleaner is guaranteed to function satisfactorily in any make of steam- or vapor-cleaning machine.

IN THE BACK SHOP AND ENGINEHOUSE

Valves to The Rescue

*By J. H. Gibson**

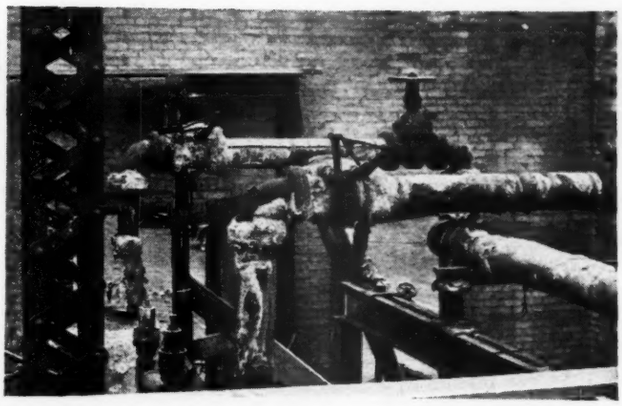
On March 30, 1938, as the power plant engineer stood, watch in hand, ready to blow the 5 o'clock whistle ending the day's shift in the South Pekin, Ill., enginehouse and yards of the Chicago & North Western, nature decided that the puny efforts of man should be more conclusively terminated.

A tornado appeared on the horizon and within approximately 90 seconds swept through this small town of some 800 persons, killing 15, wrecking houses, blowing railroad cars into cornfields, collapsing coal chutes and generally playing havoc.

Among the buildings damaged were the Chicago & North Western enginehouse and power house. This power house was equipped with a 115-ft. high brick stack connected through sheet metal breeching to four 125-hp. horizontal return tubular boilers. The velocity of the wind and the low barometric pressure combined to lift the upper 90 ft. of this stack into the air and drop it on the power house roof where two of the four boilers were under 125 lb. steam pressure.

As the steel roof of the boiler room was quite sturdy the weight of this collapsed stack did less damage than would be expected. The boiler settings were not greatly damaged although the main header piping and boiler leads were broken off. Due to the exceptionally high requirements of the Chicago & North Western in matters of safety equipment for employees, passengers and property protection, these boilers had been equipped with Crane-Erwood line protection valves in the boiler leads. These valves were installed in 1912 when the boiler plant was built in an emergency. When the boiler leads from the two working boilers were broken off beyond these valves they immediately closed, due to the high velocity of the escaping steam, protecting the nearby men.

Airplane view of the South Pekin, Ill., enginehouse of the Chicago & North Western after it had been hit by a tornado at 5 p.m., March 30, 1938. Fifteen lives were lost in the town of 800 persons



A close-up view of two Crane-Erwood line protection valves in the boiler leads of the South Pekin, Ill., power plant of the Chicago & North Western enginehouse

The upper 90-ft. of this 115-ft. stack was lifted in the air and dropped on the power house, breaking off the main header piping and boiler leads

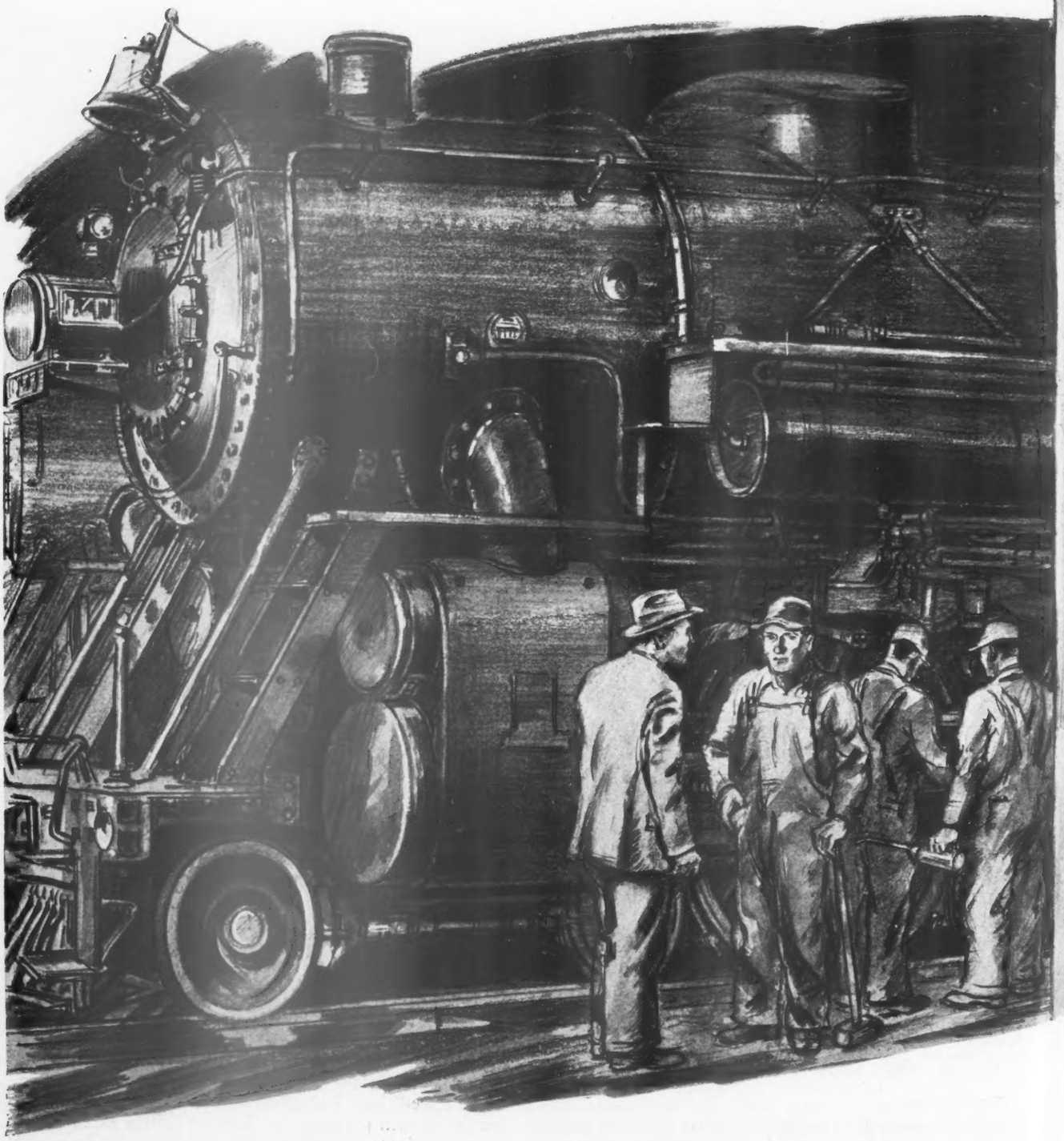
At the approach of the storm William Vogel, who for the past 18 years has been employed by the Chicago & North Western as a car and locomotive painter, had left his own shop and sought protection from the wind and flying debris in the blow-off aisle of the power house. This placed him immediately below the main steam header in such position that had the boilers exploded or the steam from the boilers continued to escape he would doubtless have been badly injured and quite possibly killed.

Division Master Mechanic L. A. Hardin, South Pekin, explains that his maintenance records indicate that these valves had been kept in good working order, along with other equipment in the plant, by a 15-day check-up consisting of proper oiling and testing for free movement

(*Continued on page 491*)

* Railway Sales, Crane Company, Chicago.

It's That Way Now

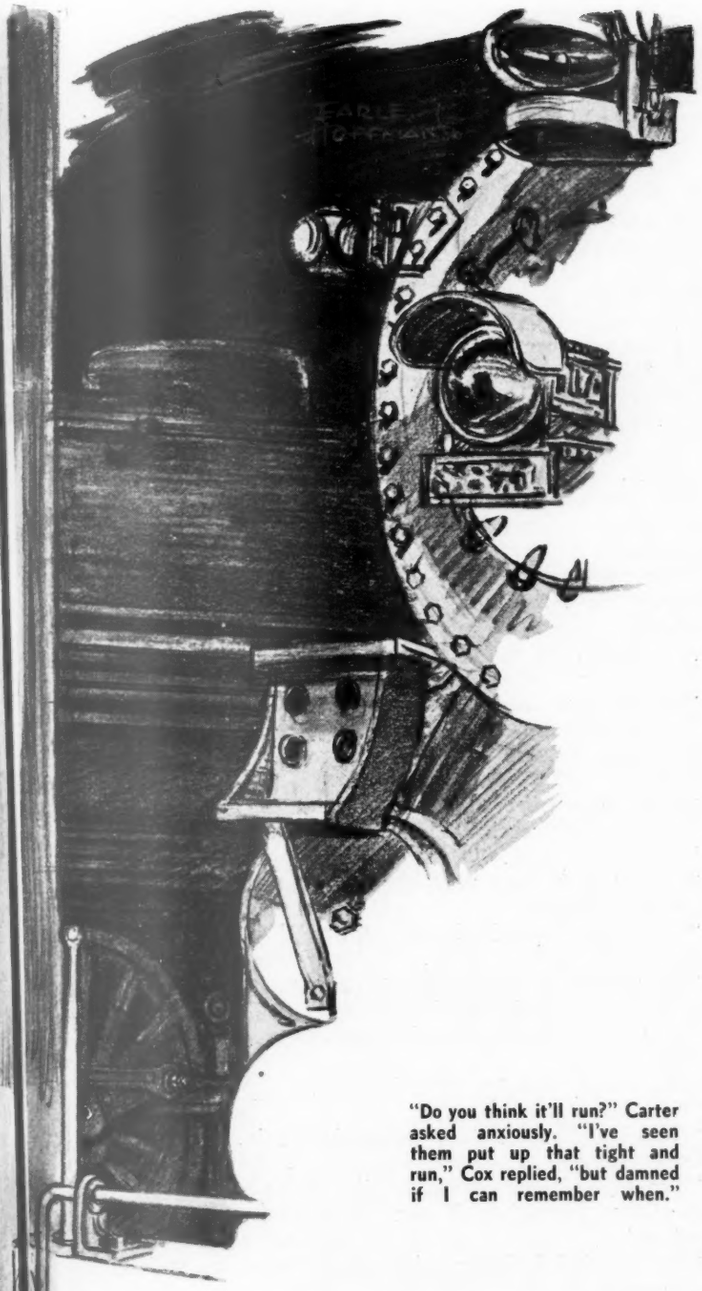


"THE failure was disgraceful," H. H. Carter, master mechanic of the Plains Division, glared at Jim Evans, roundhouse foreman, "disgraceful, I tell you, and the man that put the job up should be taken out of service!"

Evans shifted his hunk of "horseshoe" from one cheek to the other before replying. "Yes, it was bad, but Cox is one of our best machinists and——"

"His record don't show it!" the master mechanic cut in more emphatically than grammatically. "Two investigations in less than two years and now a middle connection bushing he puts up runs hot, ruins the pin and delays a perishable train three hours! Good man—huh! Thirty days to think it over might make him a better man!"

Evans squirmed uncomfortably. He knew that in one sense the master mechanic was right; on the other hand,



"Do you think it'll run?" Carter asked anxiously. "I've seen them put up that tight and run," Cox replied, "but damned if I can remember when."

conditions were such that Evans believed taking the machinist out of service would be an injustice.

"It was partly my fault," Evans said hesitatingly. "Of course, Cox should not have O.K.'d it without knowing it would go, but it was either that or delay the train and work overtime. I might have done the same thing."

"There you go trying to protect Cox," Carter said, "just like you did last time. It was the same way with Harris and Johnson. Are all the men that have engine failures your best mechanics?"

"Just about," Evans replied. "You see, the best men are on the kind of work that might fail. If I didn't put the best men on such work there would be a lot more failures."

"Stuff and nonsense!" the master mechanic exploded. "That's what's the matter with this place now, picking certain men for special jobs! They're all mechanics—they get the rate, don't they?"

"Yes," the foreman replied, "but some are better than others."

by
Walt Wyre

• • •

"Well, it's time you stopped babying them. Put them on jobs as you come to 'em and send the ones that can't do the work back to the farm where they belong! See that you do it, too!" Carter reached for a letter indicating that the conversation was over.

Evans hesitated a moment then turned and left the office. He knew there was no use trying to argue the question at the moment. The foreman was at least satisfied that he would not be forced to pull Cox out of service. As he walked back to the roundhouse, Evans mentally reviewed the failure.

IT was on the 5086. She was scheduled to go over the drop pit for classified repairs. The hostler ran the engine in the house and she wasn't blown down because she was to be run over the pit as soon as the 5088 came off. He was going to use a 2700 on the reefer train, but the dispatcher called at 4:00 and said to use a 5000, they were picking up eight cars of cattle and a 2700 wouldn't handle it. The train was called for 5:20 and there wasn't any other 5000.

Evans told Cox to look the engine over and repair what was absolutely necessary. The right middle connection bushing might have run, if a Federal inspector didn't see it, then again it might not. Cox decided it should be renewed and went at it. That would have been O.K. if the lathe man had made the bushing to fit the greatest diameter of the pin which was out of round and tapering.

The bushing started O.K., went about half way, then stuck. "Bump it a couple of licks," Cox told his helper.

The helper hit the bushing three or four blows with a piece of 4 x 4 oak. It moved about an inch and got tighter. "Pretty tight," the helper said.

"Yeah." The machinist tried to pull the brass out. It wouldn't budge.

At that moment Evans came by. "How you coming?" the foreman asked.

"O.K.," Cox replied. "This bushing is a little tight, but I think it will go."

The foreman moved on. The bushing did too, with the assistance of an eight-pound sledge.

When the bushing was in place, Cox looked at it and scratched his head. "I've seen them put up that tight and not run hot, but damned if I can remember when!"

"About ready to go?" It was the hostler come to take the engine out of the house.

"Just a couple of minutes," Cox said. Then to his helper, "Give her plenty of grease and hope it runs."

It didn't; hence the conference between the foreman and master mechanic.

NEXT morning following the pow-wow in the office, the master mechanic was in the roundhouse before eight o'clock. Evans was at the board sorting work slips.

"Remember what I told you yesterday about the work," the master mechanic reminded.

"I'm starting now," Evans replied as he began to rearrange the work slips.

When the eight o'clock whistle blew the men ganged around the desk at the board unaware of the surprises in store for them.

Machinist Jenkins from past experience expected his first slip to read "line down wedges." In the past eight years, most of Jenkins' work had been lining driving box wedges. It's a job that requires no great amount of skill or mechanical ability and Jenkins can qualify on both counts.

He was as surprised as a Republican at being appointed postmaster when he read the slip. "Examine valves, both blowing badly." The engine was the 5071 marked up to be run at 10:15 p. m. on the Limited.

Brown, another hammer and chisel machinist, had been getting by on superheater units, tank trucks and such work. He can get dirtier, make more noise and do less work than any other machinist in the roundhouse at Plainville. Some imp of perversity must have nudged Evans' elbow when he placed a slip reading "engine very lame, square valves" in Brown's box.

When the machinist read the slip, he had the appearance of a man that wished for an elephant—and got it.

Reed, Johnson, and Cox are real machinists that take pride in their work. Circumstances sometimes forced them to take chances and sometimes they lost. But when a job put up by either of the three turned out badly, it was always a crushing blow to their pride. The jobs assigned to them that morning didn't do their pride any good.

Reed drew a set of superheater units, Johnson got a miscellaneous assortment of lining down driving-box wedges, changing a pair of tank wheels and such, while Cox was assigned to taking out draw-bars on a couple of engines due for a three-month test.

After the jobs were assigned, Evans went to the office, looked in his locker to see if he had any aspirin tablets and sat down to look over the mail.

Looking over the mail was about all, for his mind was not on it. His thoughts were in the roundhouse and of what was happening there. He had done just what he had wanted to do ever since he had been foreman and he knew it wouldn't work out. Theoretically, all mechanics of a craft are equal; practically, there's a lot of difference, and any foreman that fails to recognize and take advantage of that fact is likely to hub a streak of hard luck.

The good men get the particular jobs and suffer the consequence, that's what they get for being good men; while the hammer and chisel artists fall heir to work that is nearly fool proof.

EVANS couldn't stand the strain of sitting and wondering very long. He took a fresh chew of "horseshoe" and headed for the roundhouse.

As the foreman was walking by the 5079 he heard a flow of profanity that would have put a Missouri mule skinner to taking lessons in the art of swearing. Evans leaned over and peered between the locomotive drivers. Machinist Johnson and his helper were down in the pit and Johnson was really down. When the foreman looked, the nut-splitter was just raising up.

"What's the matter, Johnson?" Evans asked. "Having trouble?"

When Evans spoke the machinist involuntarily jerked his head to look up. When he did his head struck a spring hanger. That invoked another stream of profanity.

"Dammit," Johnson said, "I stepped on a gob of grease and fell. Then," he added, "I bumped my head. If I've got to do this kind of work, I wish they'd keep grease out of the pits!"

"I thought I heard you say just a few days ago that you were getting tired of boring cylinders," Evans reminded. "You said then you wished you could get on a job where there wasn't any responsibility."

"Yeah," Johnson replied. "I might have said it, but I was just bellyaching—didn't mean anything."

The foreman went on down to stall number five where Brown was running over the valves on the 5076. The machinist had figures all over the right cylinder casing and was beginning on the left.

"How you coming?" Evans asked.

"O.K., I guess," Brown replied hesitatingly. "It's been some time since I had any experience with a Walschaert valve gear," Brown added.

"Didn't you say not very long ago that you could square a set of valves as well as Harris or anybody else?" Evans asked.

"I meant when I'm in practice," the machinist replied, "but I'll get her O. K."

"If you don't," Evans said, " I don't want to hear you complaining any more about superheater units."

"Oh, I don't mind superheater units," Brown replied promptly.

The foreman smiled as he turned to walk away. At least some good was being accomplished by the shuffle of mechanics.

Near the lineup board, Evans met the master mechanic. "How are things going?" the master mechanic inquired.

"Oh, about as usual, I guess," the foreman replied. "I've got the men switched around as you suggested."

"How is it working?"

"Can't tell yet," Evans replied. Then another idea struck him. "But I wish I had waited until some other time."

"Why some other time?" the master mechanic asked.

"Oh, nothing much." The foreman turned as though going to walk away.

"Well, tell me why now is not as good time as any," the official insisted.

"Oh, I had some business uptown," Evans told him, "and now I can't get away. It doesn't matter."

"Go ahead," Carter said. "It's not so many years since I ran a roundhouse."

"You mean you'll run the roundhouse until I get back?"

"Why not? Don't you think I can?"

"Certainly, but——"

"Go ahead," the master mechanic cut in. "I'll take care of things."

"Thanks." Evans started to the office wearing a grin that almost pierced each ear. "I'll be back late this evening."

"Never mind," Carter said. "in the morning will be soon enough."

WHEN the foreman had left, Carter went on through the roundhouse stopping at each locomotive to look it over. He was standing in front of the 5090 watching and listening while machinist Reed wrestled with a set of superheater units.

Reed, usually careful of his appearance, had put on a freshly laundered suit of overalls that morning but no one would have guessed it. The machinist had gotten wet and soot was caked on the blue denim in heavy layers. An almost new pair of tan shoes would never be tan again. His eyes, glittering from suppressed anger, shone from a soot blackened face. He didn't like it, that was evident, but he was working with a will.

The master mechanic watched a while and walked on.

Carter's next stop was at the engine where Jenkins was pulling the valves on the 5071. Profanity seemed the order of the day for Jenkins was swearing too. Not loud, but fervent.

Every move the machinist made seemed to be the

wrong one. Tools were scattered all around, lying on the pilot and every place near. Some had fallen in the pit. The right valve was out ready for inspection. The machinist was working on the left.

"Well, how you making out?" the master mechanic asked.

"Not worth a damn!" The machinist, intent on his work, had not noticed who he was talking to. "I haven't got the right tools for this work." Then Jenkins looked up. His face turned red as a new main line caboose. "I'll have this one out in a little bit."

Carter examined the right valve bull ring and bushings. "This one is cut pretty bad," he said. "It'll need new bushings."

While Carter was examining the valve bushing, John Harris, the roundhouse clerk, came up. "The dispatcher wants two 5000s for extras east," the clerk said. "I gave him the 5068 for the first one. Evans said it was O.K. What shall I give him for the second?"

"I'll let you know in a few minutes." Carter headed through the house at a brisk walk stopping in front of every 5000 to look at the work report. Not a one of them could be made ready to run in a reasonable time. Carter decided to use the one that came in on the first run on the second. It was to run one hour later.

Just before noon, the master mechanic acting foreman went to see how Brown was getting along with squaring the valves of the 5076. It was marked up to run at 2:15.

Brown had made changes at every place changes could be made. Somehow every change for the worse. He was running the valves over for the twentieth time when Carter came up. His helper was at the throttle running the engine.

"About to get her?" Carter asked.

"Well, I don't know," the machinist replied doubtfully. "I'm a little rusty."

"Let me look at it." Carter signalled the helper to back the engine.

The master mechanic ran the valves and scratched his head. According to his calculations, only a slight change would be needed to eliminate reverse entirely. The twelve o'clock whistle caught the men wondering what to do next. Carter, somewhat out of practice was further befuddled by what the machinist had done.

"Haven't we got a machinist here that is in practice on valves?" the master mechanic asked testily.

"Yes, Reed is."

"Where is he?"

"Down on the 5090 pulling some superheater units," Brown said, "or was; I guess he's gone to check out now."

"Well, catch him and tell him to work noon hour," Carter said. "And if you know anything about taking out superheater units, get on the 5090 at 1:00."

"Yes, sir," the machinist replied. "I've pulled more units than any man here."

THE 5097 came in on the first extra east in good condition except the left main pin was stinking hot. Carter had figured to work it on the lead and not run the engine in the house. One look at the hot pin told him it would be inviting a failure with possibly a lot of damage to run the engine.

"Get it in the house soon as you can," Carter told the hostler.

The dispatcher agreed to set the call up on the second train forty-five minutes which was some respite.

Jenkins was waiting for valve bushings from the machine shop at the time. The master mechanic had told him to work the 5090.

The hostler got the engine in the house in record time and Jenkins went to work taking the rods down. The machinist, more nervous by the official's presence, was all thumbs. He picked up the wrong wrench, dropped it, and picked up another that didn't fit.

Carter got nervous too. At the rate Jenkins was starting, the pin wouldn't be ready to caliper in an hour. Then the master mechanic remembered what Evans had said about Cox. "Go get Cox to help on this job," he told Jenkins' helper.

Jenkins did the helping while Cox did most of the work. The lathe man was waiting, calipers in hand. He already had a brass in his lathe and the first cut taken.

The machine man turned out the bushing in short order. A little more time would have made a better fit. It was plenty tight, but a few raps with a sledge drove the bushing home.

"Do you think it'll run?" Carter asked anxiously.

"I've seen them put up that tight and run," Cox replied, "but damned if I can remember when. Give her plenty of grease and it might run."

When the job was finished Cox went back to his drawbars and Jenkins returned to his valves. The bushings were ready for the left side and he started pressing them in.

The front bushing was tight but it went with a lot of persuasion. The master mechanic watched it pressed in. Then he examined the bushing. His face turned purple. He tried to speak but only succeeded in sputtering.

Jenkins looked and his face turned purple too. The bushing was turned so that ports didn't line up.

After an hour trying to pull the bushing, Carter told the machinist to have the bushing cut out. He then went in search of machinist Cox. "Say, can you put in valve bushings?"

"I have," Cox replied.

"Well, go down to the 5071 and tell Jenkins to finish with these draw-bars. And," he added, "stay with the 5071 until you get it done."

Evans returned just before five o'clock. He walked through the house and to the desk. "How did things go?" he asked the master mechanic.

"Not so hot," Carter replied gruffly. "I had to change the men around a little to get any work done. They've been on one thing so long they can't do anything else."

And Evans knew enough to keep his mouth shut. It was a day well spent and he had enjoyed sitting around home a few hours.

Valves to The Rescue

(*Continued from page 487*)

as well as being opened approximately once a year, examined and repacked. On one occasion some time ago new stems had been installed, otherwise no repairs had been made in the 26 years these valves had been in service.

The accompanying illustrations indicate the extensive damage as well as the general layout of the boilers and piping. Forethought by the railway engineers who designed this plant, coupled with the quality of safety devices, doubtless in this case not only saved a life but minimized capital investment loss as well.

The National Safety Council's safety award for 1937, signifying the council's highest recognition for Class A railways, was awarded to the Chicago & North Western May 16, 1938. In the last eight years the North Western has led this group five times and been runner-up

the other three times. The presentation was made by D. D. Fennell, chairman of the Award committee, with Fred W. Sargent, president of the North Western, accepting it in behalf of the railway company. President Sargent paid tribute to his employees and to employees of other railroads who have striven to improve their safety ratings. The Class A group includes 19 railroads, these which have registered 50,000,000 or more man-hours of work during the year. In addition to the Class A contestants there were 146 other railroads in the competition.

Incipient Axle Cracks Located Electrically

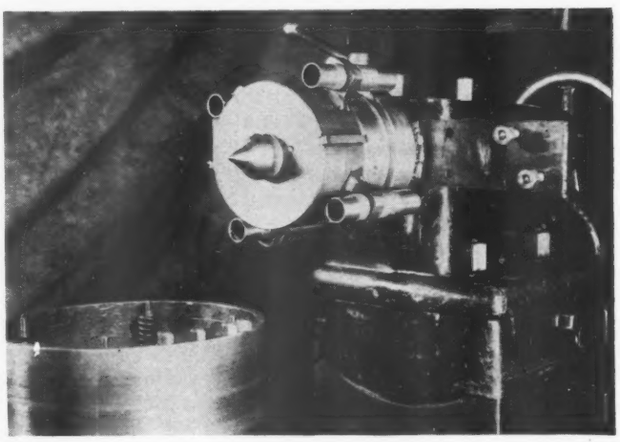
Over a period of years, railroads have been subject to derailments because of fatigue failures in axles, which usually occur in the wheel seat, approximately ½ in. in from the edge of the wheel. Axles can be tested satisfactorily only when wheels have been removed. A new method, perfected by the Sperry Products, Inc., Hoboken, N. J., locates cracks not visible to the eye or under a magnifying glass. In this method, a heavy alternating current is passed through and concentrated at the surface of the axle as it is rotated in a lathe; any cracks in the axle will cause changes in the voltage gradient along sections of the axle. These voltage changes are automatically recorded on paper, thus making a permanent record of the condition of the axle in regard to cracks; therefore, potential seats of failure are obtained without depending upon either the technique or the watchfulness of the operator.

The testing eqiupment is designed for installation in standard lathes, and can be handled conveniently in any regular shop. It consists of current heads, brush carriers, a transformer, a searching unit, an amplifier and a recorder.

The current heads are designed to operate continuously with a testing current of 1,000 amp. and have ample brushes designed to maintain low temperatures. The brushes operate on cast-bronze slip rings provided with copper-mesh contact pads which insure uniform current distribution through the ends of the axle. The axle ends are cleaned to secure sufficient testing current. The journal and wheel seats must also be cleaned to secure good searching-unit contact.

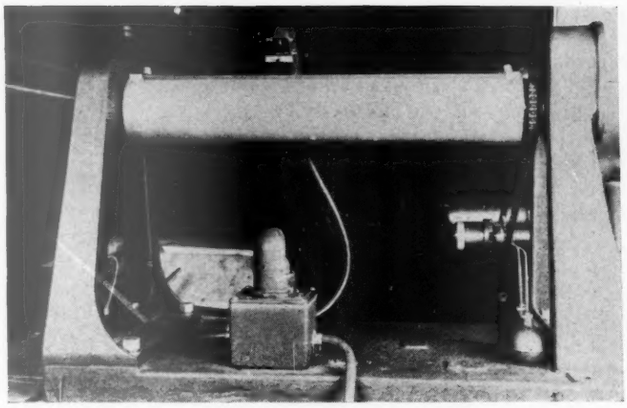
The searching unit consists of two accurately positioned contact members made of a special alloy and designed to allow maximum rotary testing speeds. These members are spaced longitudinally on the axle to measure continuously variations in the voltage gradient resulting from changes in conductivity caused by flaws at or near the surface of the axle. By means of spacing, selecting and design of the contact members, operating speeds ranging from 16 to 40 r.p.m. are practicable.

The recorder comprises a rotary drum driven synchronously with the axle relay, which functions whenever the voltage at the searching unit rises above a predetermined value. Normally, the paper chart, wrapped on the rotary drum, shows one spiral inspection of the axle per $\frac{1}{16}$ in. of chart. The chart record removed from the drum constitutes a diagram of the surfaces tested, showing defective regions where the voltage was higher than the calibrated value. The recorder is fitted with a Neon lamp visible to the operator during testing; this lamp is



The tailstock current-head carrier unit before application of the contact pad and slip-ring casting shown in the left-hand corner

Sperry axle-testing equipment—A current is passed through the axle and a searching unit mounted in the tool post picks up any change in voltage gradient induced by cracks—Voltage changes are recorded on charts



The recording element used with the Sperry electric axle-testing equipment

in series with the record pen, and provides a means for visual testing if records are not required.

The amplifier equipment consists of a high-gain voltage amplifier and a low-gain power amplifier operating into a galvanometer relay to actuate the indicating and recording apparatus. Both amplifiers utilize standard types of radio tubes. The equipment includes meters for maintaining operating level, means for calibrating the amplifier system, and means for adjusting the detection range.

The transformer used with the apparatus has a capacity of approximately 32 k.v.a., intermittent, at 50-60 cycles, which is sufficient to provide working results. The transformer will supply 4, 5, 6, 7 or 8 volts by primary tap connections to provide flexibility in setup.

Setting up the current heads in the lathe involves no difficulty. To accommodate the headstock current head, a chuck is applied to the lathe headstock spindle, the chuck being of sufficient size to take a 3¼-in. stub shaft on the current head. An extension shaft, screwed to the stub shaft, provides direct recorder drive.

The headstock current-head assembly is lifted into the lathe, the recorder drive shaft being passed through the headstock spindle while the stub shaft is clamped in the chuck; the jaws of the chuck are centered so that the center runs true within 0.010 in.

A simple jaw clutch is then assembled on the end of the recorder drive shaft; this enables the recorder drum to be turned, for purposes of record inspection or for initial-position adjustment relative to the axle, independent of the lathe. The recorder is set up adjacent to the lathe and driven by a roller chain running over a clutch sprocket.

Installation of the tailstock current-head assembly includes a carrier unit rotating on ball bearings, which accommodates the contact pad and slip-ring casting. The tailstock spindle is run out, after removing the center, until it projects about 6 in.; the carrier unit is then mounted thereon in a manner which leaves it free to rotate on its ball bearings. The tailstock end of the lathe thus becomes equipped with a live center which permits the slip ring and contact pad to rotate freely with the axle under the end thrust applied to maintain current.

The searching unit is set up in the tool post of the lathe with its contact points lying on a diameter of the axle wheel seat. The searching unit is completely insulated from the tool post and is connected by a two-wire cable plug to the amplifier at a central control cabinet.

The amplifier equipment, located in the cabinet, is operated as a constant-gain device with the complete system voltage-regulated, so that changes of plus or minus 10 per cent in line voltage or strong voltage surges at large defects produce negligible change in testing sensitivity.

During operation, the sensitivity of the detecting unit is set as desired so that only changes of a predetermined magnitude will be recorded. The set can thus be used to find flaws without interference or confusion which might be caused by surface irregularities.

The operating level (average input voltage) varies very slightly on a uniform axle section. Changes in cross section are adjusted for by the operator in routine order. Testing of straight sections requires no adjustment up to the point of tangency at fillets; the operator can, if necessary, examine the important part of a fillet by careful adjustment of the gain control at this region.

Such testing should result in further service life for axles, which are arbitrarily condemned after a given period of service; each axle can be disposed of according to the test results.

Cylinder Welding Car

The welding of locomotive cylinders on the erecting floor, in addition to requiring floor space not conveniently available at all times for the construction of furnaces, also creates more or less fire hazard because of wood floors. The welding car, illustrated, is used at the Northern Pacific shops, Brainerd, Minn., proving quite satisfactory in this service. Its use avoids crowding of the erecting floor, eliminates fire hazard and permits welding to be done under most favorable conditions.

Kept in the enginehouse adjacent to the erecting shop, the welding car is moved to the erecting floor where cylinders to be welded are loaded on the car by an overhead crane. The car is then returned to the enginehouse where cylinders are prepared for welding. Furnaces are built around the cylinders which are pre-heated with a coke fire. After welding, the cylinders are allowed to cool slowly before the furnaces are dismantled, and the car is moved back to the erecting floor for unloading the welded cylinders.

This car was constructed using the underframe from a dismantled Lidgerwood car on which are placed sheets

Cylinder welding car used in welding dismounted cylinders outside of the erecting shop

of 1-in. boiler plate supported by pieces of rail to prevent transmitting of any great amount of heat from furnaces to car. Steel supports on the sides of the car are for erection of a scaffolding used by welders and may be moved to suit the position on the car of the cylinder to be welded. Car jacks, shown under the side of the car are used to prevent the car rocking and dislodging the brickwork of the furnaces.

Locomotive Boiler Questions and Answers

By George M. Davies

(This department is for the help of those who desire assistance on locomotive boiler problems. Inquiries should bear the name and address of the writer. Anonymous communications will not be considered. The identity of the writer, however, will not be disclosed unless special permission is given to do so. Our readers in the boiler shop are invited to submit their problems for solution.)

The Manufacture of Charcoal-Iron Boiler Tubes

Q.—How are charcoal-iron boiler tubes manufactured?—J. S.

A.—The following method of manufacturing charcoal iron tubes, used by the largest manufacturers of charcoal iron tubes, consists of four processes, each of which is a separate operation in its particular mill. These processes are (1) the manufacture of the charcoal-iron blooms from the raw materials by the knobbling process, (2) the reduction of the iron blooms into bars, (3) the rolling of the bars into skelp, and (4) welding the skelp into tubes.

The raw material is charged into the hearth of the knobbling forge along with charcoal. A cold air blast is applied and the metal is slowly fused. The metal is worked until it matures, that is, until globules of iron form. During the working, the action of the charcoal rids the iron of impurities, leaving a lump of commercially pure charcoal iron. The lump, as it comes from the forge fire, is a rough, porous mass made up of globules of charcoal iron, each covered by a thin coating of slag or cinder.

Immediately after the lump has been formed at the forge, it is removed and placed under a shingling hammer and hammered into a bloom of the required size. In this operation the globules of iron are welded together, the thin coating of slag or cinder remaining between the particles of pure iron, and thus producing planes of separation which protect the iron against corrosion, pitting, and the action of acids. The cinder coating has a very important bearing upon the physical properties of charcoal iron.

The bloom is charged into a coal-fired reverberatory heating furnace, slowly brought up to a welding heat, and then rolled on a bar mill into a charcoal-iron bar. The heating and rolling operation has a refining action upon the iron. The globules that existed in the original lump attain an elongated, fibrous structure. Each subsequent heating and rolling further refines the iron.

The bars are cut in lengths of 2 or 3 ft., placed one above the other, and wired together in a pile of sufficient size and weight to produce skelp of a specified width and thickness to make a certain size tube. The pile is charged into a reverberatory heating furnace chamber which is separate from the coal chamber, thus preventing the iron from absorbing impurities from the coal. Here the iron is allowed to attain a welding heat.

The heated pile of bars is rolled on a roughing mill to about ¼ in. thickness. During the several passes through the roughing rolls, the bars are thoroughly welded together, an extra thick layer of protecting slag occurring between the bars. The strip of skelp is then passed through planishing and finishing rolls, where it is brought to required thickness and the edges scarfed.

From the scarfing rolls the strip of skelp is conveyed to the shears, cut to proper tube lengths, and while still hot is drawn through dies which form it in a tubular shape, with the scarfed edges overlapping, ready for welding.

The formed tube is charged cold into a gas-fired furnace, and upon reaching welding heat is pushed up to the welding rolls, with the lap up. The tube passes through the rolls over a mandril and is thoroughly welded. Charcoal iron welds easily, but to assure a perfect weld, the tube is first set aside to cool, after which the heating and welding processes are repeated. The tube is run through the sizing rolls to reduce it to proper size and then through the cross or hot straightening rolls. After cooling, the tube is run through a cold straightener, thus assuring a straight tube.

Plugging of Superheater Tubes Below the Arch

Q.—On engines having two syphons we put the arch down to the tube sheet and carry it seven bricks high. These engines have a tendency to plug the two top superheater tubes, one on each side of the syphons; in other words, we clean these tubes when we wash out the engine and in one trip they will come in with the four superheater tubes plugged. Other engines of the same class without syphons will go a whole month without the tubes becoming plugged.

I have thought that such plugging occurs because of the small clearance between the crown and side sheets and the syphons, and because, with the Standard stoker firing fine coal, the coal would be fired with a sharper force on each side of the syphon. We have to dig these tubes out with an iron bar for about 1 ft. before we can blow them out.—B. C. H.

A.—The information given in the question is insufficient to determine the cause of the trouble experienced. It is apparent that for some reason there is insufficient draft through the tubes in question or that these particular tubes are being required to pass more cinders than they can handle. It is possible that the front of the syphons are located too close to the firebox tube sheet, and, with the use of a stoker, the fine cinders are being diverted by the syphons; thus, the amount of the cinders going through the tubes, which are in line with the sides of the syphons, is materially increased, especially at the top due to the action of the crown sheet in also diverting the cinders, causing these particular tubes to become plugged.

The question of proper arch would also have considerable effect upon the plugging of the tubes and should be checked.

The fire arch in modern locomotives should be of sufficient length so that the gas opening between the back end of the arch and crown sheet, or the gas opening between the back end of the arch and the fire door sheet, does not fall below the total gas area through the tubes and flues; preferably, the opening above the arch should be 115 per cent of the tube and flue area. The same proportion should exist between the back end of the arch and the door sheet.

(Turn to next left-hand page)

High Spots in

Railway Affairs . . .

Labor Will Co-operate

Generally speaking, and aside from some of the things that George Harrison, chairman of the Railway Labor Executives Association, said in the heat of the recent wage controversy, he is regarded as pretty well balanced and more or less of a statesman in the union labor field. In commenting at the recent Triennial International Transportation Conference of the Y. M. C. A. of North America, at Toronto, on remedial measures which should be adopted by the government in dealing with the railroads, he made the following statement: "Along with that I think there is a splendid opportunity for labor to make its contribution not only directly by influencing policies that will permit transportation to develop and grow, but by bringing to the public a better understanding of the problems of the industry and the necessity for fair treatment to that great agency so essential to the development and growth of the country."

Recommends Federal Department of Transportation

Chairman of the Interstate Commerce Commission W. M. W. Splawn, in an address before the National Association of Railroad and Utility Commissioners in New Orleans, recommended that a Department of Transportation be created by the federal government that would be an executive department in which could be lodged all of the promotional and other activities now carried on by eight or ten different departments and authorities. The Interstate Commerce Commission would be relieved of many of its present activities and would exercise jurisdiction, under federal statutes, over rates and fares and the prevention of discriminations in rates and fares.

Fiddling While Rome Burns

Under the leadership of Senator Burton K. Wheeler, chairman of the Senate Committee on Interstate Commerce and Railroad Finance, constructive measures for the relief of the railroads were carefully avoided last year and lengthy hearings were devoted to digging into railroad financial practices. What will the Senate do in the next Congress? While other agencies interested in transportation are suggesting practical and constructive measures for strengthening the railroads, Senator Wheeler announced at the Fourteenth New England Conference that he had prepared two bills for presentation to Congress. One of these proposes to make it easier for railroads not in trusteeship or receivership to borrow money for renewals and repairs, giving them the privilege of granting a prior lien for new money borrowed for such purposes. Another bill provides standards for railroad reorganizations. These may be all very well, but what are the Senator and his committee going to do to put through other measures which will relieve the railroads of some of the unfair handicaps under which they are now operating?

President's Committee-of-Six

Blocked in all directions in the effort to save themselves from financial disaster, the railroads have now only one way in which to turn, and that is to the Administration and Congress for remedial legislation. Among the many agencies which are giving consideration to this problem is the so-called President's Committee-of-Six —three representatives of railroad management and three from the railroad labor unions (October issue, page 397). This committee, appointed by President Roosevelt, promptly resumed its activities after the wage controversy settlement and met in Washington on November 7. It is understood that the day was spent in discussing the situation and that each member will individually prepare recommendations for later consideration by the committee as a whole. The labor members of the committee are George M. Harrison, chairman of the Railway Labor Executives' Association; D. B. Robertson, president of the Brotherhood of Locomotive Firemen and Enginemen, and B. M. Jewell, president of the Railway Employees Department, American Federation of Labor. The representatives of management are Carl R. Gray, vice-chairman of the Union Pacific; M. W. Clement, president of the Pennsylvania, and E. E. Norris, president of the Southern.

Shippers Also Worried

Even the shippers, as represented by the National Industrial Traffic League, are greatly concerned over the precarious condition in which the railroads find themselves. At a meeting of the League, recently held in New York City, certain parts of the railroad legislative program suggested by the Association of American Railroads were approved. These include loans to the railroads; repeal of land-grant statutes; withdrawal of the government from the Federal Barge Line as soon as a buyer can be found; tax relief measures; credit for railroad unemployment insurance taxes to the extent of employee dismissal allowance actually paid; amendment of the Clayton Act and amendment of the laws authorizing the appearance of government officers in rate cases. The league either opposed or took no action on the other recommendations. It did appoint a special committee on the railroad situation, however, which was given rather broad powers, in order that it might act effectively during the legislative crises of the next few months. This committee was characterized by the officers of the League as comprising the most influential members of that organization.

Railroad Transport Clinic

The Transportation Conference sponsored by the U. S. Chamber of Commerce was mentioned in the High Spots of our October number. It held a second meeting during the latter part of November and adopted a number of resolutions suggesting lines along which relief should be granted to the railroads. Among these were resolutions suggesting means for facilitating reorganizations; the repeal of the land-grant statutes; relief of expense in excess of net direct benefits for elimination of railroad grade crossings, and the reconstruction of railroad bridges in connection with navigation or flood control projects; relief from the undistributed profits tax; the avoidance of such restrictive measures as the train length limit bill, excess crew laws, six-hour day legislation, etc.; that Congress should require the government to dispose of the Federal Barge Line to private parties; and that the Railroad Labor Act should be amended (a) to include public members in odd numbers on adjustment boards so as to insure disposition of each case in the first instance; (b) to authorize federal court review of adjustment board decisions at the instance of the railroads, as now allowed employees; and (c) to place a limit upon the time within which claims can be presented. Resolutions were also passed with recommendations to facilitate consolidations, to speed up the disposition of abandonment applications, etc.

(Turn to next left-hand page)

Among the Clubs and Associations

Mechanical Division Convention

THE General Committee of the Mechanical Division, A. A. R., at a meeting in New York on Wednesday, November 16, decided to hold a three-day convention in New York next year. The exact dates will depend upon arrangements which can be made for convention facilities, but the meeting will probably be held late in June. The transportation exhibits at the World's Fair will take the place of the exhibit which is ordinarily associated with conventions of this organization.

Railroad Engineers Get A. S. M. E. Awards

DURING the annual meeting of the American Society of Mechanical Engineers, held at New York during the week beginning December 5, two railroad men received honors and awards. Lawford H. Fry, railway engineer, Edgewater Steel Company, Pittsburgh, Pa., received the Worcester Reed Warner Medal, bestowed for an outstanding contribution to permanent engineering literature, for his "written contributions relating to improved locomotive design and utilization of better materials in railway equipment." A. I. Lipetz, chief consulting engineer in charge of research, American Locomotive Company, Schenectady, N. Y., was presented with the Melville Medal for 1938 for his paper on "The Air Resistance of Railroad Equipment."

A. S. M. E. Railroad Division

CHAS. T. RIPLEY, chief engineer, Technical Board of the Wrought Steel Wheel Industry, Chicago, is slated to head the Railroad Division, American Society of Mechanical Engineers, during the coming year. Mr. Ripley succeeds Prof. Edw. C. Schmidt, head, Department of Railway Engineering, University of Illinois, Urbana, Ill., who retired as chairman of the Division at its annual dinner and business meeting which was held on December 8, 1938, at the Midston House, corner of Thirty-eighth street and Madison avenue, New York City.

J. R. Jackson, engineer of tests, Missouri Pacific, St. Louis, Mo., was nominated by letter ballot to fill the vacancy on the Executive Committee, Railroad Division, created by the retirement of Professor Schmidt. Mr. Ripley and Mr. Jackson were recommended to the president of the society and appointed by him.

The following were elected to serve on the General Committee of the Division, terms to expire in December, 1943: F. G. Lister, superintendent of motive power, St. Louis-San Francisco, Springfield, Mo.; Prof. G. A. Young, head, School of Mechanical Engineering, Purdue University, Lafayette, Ind., and John Roberts, chief of motive power and car equipment, Canadian National, Montreal, Que.

John G. Adair, mechanical engineer, Bureau of Locomotive Inspection, Interstate Commerce Commission, Washington, D. C., was elected to the General Committee to fill the vacancy caused by the death of the late Harvey Boltwood. Mr. Adair's term expires in 1939.

Harold C. Wilcox, associate editor, *Railway Mechanical Engineer*, New York, was elected to fill the vacancy created by the promotion of Mr. Jackson to the Executive Committee. Mr. Wilcox's term will expire in December, 1940.

St. Louis Car Men Honor K. F. Nystrom

A BRONZE plaque containing the inscription "For His Outstanding Contribution to the Science and Art of Design and Maintenance of Railroad Rolling Stock" was presented to K. F. Nystrom, mechanical assistant to vice-president, Chicago, Milwaukee, St. Paul & Pacific, by the Car Department Association of St. Louis at a meeting held Tuesday evening, November 15, at the Hotel Mayfair, St. Louis, Mo. The presentation was made following an address by Mr. Nystrom on "Master Car Builders" before about 280 members and guests of the association, including a group of car-department officers from Chicago.

In discussing his subject, Mr. Nystrom said that the master car builder or car department supervisor must be a competent director, teacher, employer and builder of men. He said that car supervisors must accept whether they like it or not the responsibility for the safety, reliability and maintenance of rolling stock and that with this great responsibility goes the proportionate privilege of insisting upon acquiring the best equipment science and good workmanship can produce.

As regards the future, Mr. Nystrom said, "I am convinced that at no time in railroad history was there such great opportunity for improvement and advancement as at present. During the period of depressions since 1929, considerable changes have been made in practices and railroad operation. We are doing things today which, ten years ago, we would have said could not be done. We have eliminated

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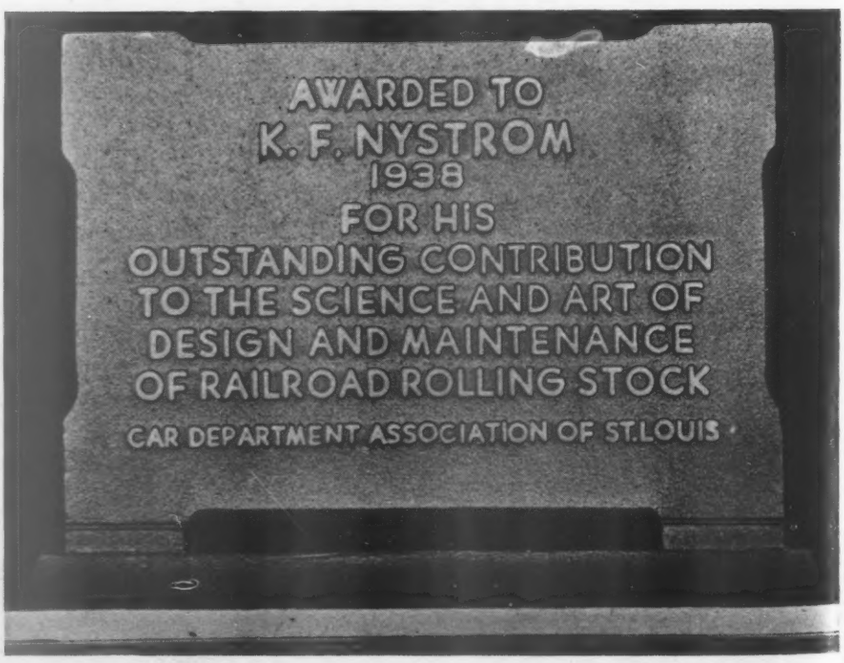

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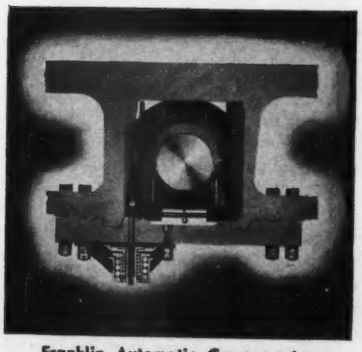
Locomotive driving boxes can "Take It", but the incessant pounding that results from an improperly adjusted wedge will soon have the locomotive in the shop for repairs . . . reduce such repairs by eliminating the cause with the application of Franklin Automatic Compensators and Snubbers.



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NEW YORK CHICAGO MONTREAL

repair tracks and inspection points, and reduced forces in greater proportion than traffic has been reduced, and at the same time, we have a better operation. At present, we have fewer hot boxes, fewer equipment failures and fewer accidents than we had ten years ago. This is an achievement in which we can take some comfort, but there are many problems which we must solve, as the speed of our trains is constantly increasing, and we have not yet reached the limit. Therefore, when anything goes wrong with the railroad machine, the damage is far more costly than in former days." Among other items which present the possibility and need for still further improvement, Mr. Nystrom mentioned trucks, brake rigging, couplers and draft gears and box car interiors designed so that they can be kept at all times "as sanitary as a modern warehouse."

"Lumber Night" at N. Y. Railroad Club

FOUR short talks and a full-length sound motion picture described the ins-and-outs of the lumber industry in general and the interdependence of that industry with the railroads in particular in a program presented by the Weyerhaeuser Sales Company of St. Paul, Minn., before 600 members and guests of the New York Railroad Club on October 28. Opening the program, F. K. Weyerhaeuser, president, Weyerhaeuser Sales Company, outlined the extent to which lumber is used in American industry and building and reviewed its production curve. He pointed out that the industry stands fourth in the number of employees and fifth in wages paid in the country and that more than 6,000,000 people depend upon it for a livelihood. He especially emphasized the fact that lumber is the only readily reproducible national resource and stated that with a modern and entirely practical schedule of reforestation and protection American forests will produce two or three times the number of trees for which markets are now available.

M. W. Williamson, manager, railroad and car lumber sales, spoke on the modernization of the lumber industry, reviewing the progressive mechanization of the processes of harvesting trees and handling them at mills. "What the Railroads Mean to the Lumber Industry" was the subject presented by I. N. Tate, vice-president and secretary of the company. In illustration of the interdependence between these two industries, the speaker cited the following railroad activities which have or had an effect on lumbering: (1) Land grant tracts given to the railroads became a tremendous source of supply for timber and the desire of the roads to secure working capital from their holdings of timber acted as a great stimulant for the sale of their lumber interests and hence to the development of the industry and the opening up of the West. (2) The willingness of the railroads to build branch lines into inaccessible timber areas widened the area of lumber operations. (3) The Transportation of products from saw mills to large markets performed by the railroads is absolutely essential, for lumber is a bulk commodity and is produced a great distance from its chief markets. For example, the rail haul of fir timber to eastern territory averages 2,600 miles. (4) Experience has further proven that they [the railroads] deliver the products of the lumber industry in better condition than is possible in any other medium of transportation. The Weyerhaeuser mills were able to increase the percentage of their all rail shipments from 61 per cent in 1934 to 69½ per cent in 1937. (5) The railroads have been large users of forest products, averaging about 20 per cent of the total products in predepression years to less than 10 per cent at present.

In discussing the volume of lumber shipped by rail, Mr. Tate declared that the lumber industry wants to ship its products by rail but is finding it increasingly difficult to do so. In illustration of this he pointed out that ten years ago certain eastern distributing yards shipped 77 per cent of their lumber by rail. This volume shrank to 17¼ per cent in 1936, to 9½ per cent in 1937 and to 5½ per cent in the first eight months of 1938. Furthermore, he said the industry in the South and West is finding it increasingly difficult to hold to rail shipment to nearby points. In conclusion the speaker said that great opportunities exist for railroad traffic in lowering transportation costs so as to make available to markets certain species and types of trees that are at present left in the woods because of unprofitability.

The final speaker, H. T. Kendall, vice-president and general manager, in discussing what the lumber industry means to the railroads, pointed out that over 7 per cent of total carloadings are lumber; that the average freight on lumber is $269 per thousand dollars of value, compared with $62 to $82 on iron and steel and $79 on stone.

DIRECTORY

The following list gives names of secretaries, dates of next regular meetings, and places of meetings of mechanical associations and railroad clubs:

AIR-BRAKE ASSOCIATION. — R. P. Ives, Westinghouse Air Brake Company, 3400 Empire State building, New York.

ALLIED RAILWAY SUPPLY ASSOCIATION. — J. F. Gettrust, P. O. Box 5522, Chicago.

AMERICAN RAILWAY TOOL FOREMEN'S ASSOCIATION.—G. G. Macina, 11402 Calumet avenue, Chicago.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS.—C. E. Davies, 29 West Thirty-ninth street, New York. Annual meeting December 5-9. Engineering Societies building, New York.

RAILROAD DIVISION.—Marion B. Richardson, P. O. Box 205, Livingston, N. J.

MACHINE SHOP PRACTICE DIVISION.—J. R. Weaver, Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa.

MATERIALS HANDLING DIVISION. — F. J. Shepard, Jr., Lewis-Shepard Co., Watertown Station, Boston, Mass.

OIL AND GAS POWER DIVISION. — M. J. Reed, 2 West Forty-fifth street, New York.

FUELS DIVISION.—A. R. Mumford, N. Y. Steam Corp., 130 E. Fifteenth st., New York.

ASSOCIATION OF AMERICAN RAILROADS. — J. M. Symes, vice-president operations and maintenance department, Transportation Building, Washington, D. C.

OPERATING SECTION. — J. C. Caviston, 30 Vesey street, New York.

MECHANICAL DIVISION.—V. R. Hawthorne, 59 East Van Buren street, Chicago.

PURCHASES AND STORES DIVISION.—W. J. Farrell, 30 Vesey street, New York.

MOTOR TRANSPORT DIVISION. — George M. Campbell, Transportation Building, Washington, D. C.

CANADIAN RAILWAY CLUB. — C. R. Crook, 4468 Oxford avenue, Montreal, Que. Regular meetings, second Monday of each month, except in June, July and August, at Windsor Hotel, Montreal, Que.

CAR DEPARTMENT ASSOCIATION OF ST. LOUIS. — J. J. Sheehan, 1101 Missouri Pacific Bldg., St. Louis, Mo. Regular monthly meetings third Tuesday of each month, except June, July and August, Hotel Mayfair, St. Louis, Mo.

CAR DEPARTMENT OFFICERS' ASSOCIATION.—Frank Kartheiser, chief clerk, Mechanical Dept., C. B. & Q., Chicago.

CAR FOREMEN'S ASSOCIATION OF CHICAGO.—G. K. Oliver, 2514 West Fifty-fifth street, Chicago. Regular meetings, second Monday in each month, except June, July and August, La Salle Hotel, Chicago.

CAR FOREMEN'S ASSOCIATION OF OMAHA, COUNCIL BLUFFS AND SOUTH OMAHA INTERCHANGE.—H. E. Moran, Chicago Great Western, Council Bluffs, Ia. Regular meetings, second Thursday of each month at 1:15 p. m.

CENTRAL RAILWAY CLUB OF BUFFALO. — Mrs. M. D. Reed, Room 1817, Hotel Statler, Buffalo, N. Y. Regular meetings, second Thursday each month, except June, July and August, at Hotel Statler, Buffalo.

EASTERN CAR FOREMEN'S ASSOCIATION. — E. L. Brown, care of the Baltimore & Ohio, St. George, Staten Island, N. Y. Regular meetings, second Friday of each month, except May, June, July, August and September.

INDIANAPOLIS CAR INSPECTION ASSOCIATION. — R. A. Singleton, 822 Big Four Building, Indianapolis, Ind. Regular meetings, first Monday of each month, except July, August and September, at Hotel Severin, Indianapolis, at 7 p. m.

INTERNATIONAL RAILWAY FUEL ASSOCIATION. — See Railway Fuel and Traveling Engineers' Association.

INTERNATIONAL RAILWAY GENERAL FOREMEN'S ASSOCIATION.—F. T. James (President), general foreman, D. L. & W., Kingsland, N. J.

INTERNATIONAL RAILWAY MASTER BLACKSMITHS' ASSOCIATION.—W. J. Mayer, Michigan Central, 2347 Clark avenue, Detroit, Mich.

MASTER BOILER MAKERS' ASSOCIATION. — A. F. Stiglmeier, secretary, 29 Parkwood street, Albany, N. Y.

NEW ENGLAND RAILROAD CLUB. — W. E. Cade, Jr., 683 Atlantic avenue, Boston, Mass. Regular meetings, second Tuesday in each month, except June, July, August and September, at Hotel Touraine, Boston.

NEW YORK RAILROAD CLUB.—D. W. Pye, Room 527, 30 Church street, New York. Meetings, third Friday in each month, except June, July, August, September, at 29 West Thirty-ninth street, New York.

NORTHWEST CAR MEN'S ASSOCIATION. — E. N. Myers, chief interchange inspector, Minnesota Transfer Railway, St. Paul, Minn. Meetings, first Monday each month, except June, July and August, at Midway Club rooms, University and Prior avenue, St. Paul.

PACIFIC RAILWAY CLUB. — William S. Wollner, P. O. Box 3275, San Francisco, Cal. Regular meetings, second Thursday of each month in San Francisco and Oakland, Calif., alternately, excepting June in Los Angeles and October in Sacramento.

RAILWAY CLUB OF GREENVILLE.—Sterle H. Nottingham, Greenville, Pa. Regular meetings, third Thursday in month, except June, July and August.

RAILWAY CLUB OF PITTSBURGH.—J. D. Conway, 1941 Oliver Building, Pittsburgh, Pa. Regular meetings, fourth Thursday in month, except June, July and August, Fort Pitt Hotel, Pittsburgh, Pa.

RAILWAY FIRE PROTECTION ASSOCIATION.—P. A. Bissell, 40 Broad street, Boston, Mass.

RAILWAY FUEL AND TRAVELING ENGINEERS' ASSOCIATION.—T. Duff Smith, 1255 Old Colony building, Chicago.

RAILWAY SUPPLY MANUFACTURERS' ASSOCIATION. —J. D. Conway, 1941 Oliver Building, Pittsburgh, Pa. Meets with Mechanical Division and Purchases and Stores Division, Association of American Railroads.

SOUTHERN AND SOUTHWESTERN RAILWAY CLUB.—A. T. Miller, P. O. Box 1205, Atlanta, Ga. Regular meetings, third Thursday in January, March, May, July and September. Annual meeting, third Thursday in November, Ansley Hotel, Atlanta, Ga.

TORONTO RAILWAY CLUB.—D. M. George, Box 8, Terminal A, Toronto, Ont. Meetings, fourth Monday of each month, except June, July and August, at Royal York Hotel, Toronto, Ont.

TRAVELING ENGINEERS' ASSOCIATION.—See Railway Fuel and Traveling Engineers' Association.

WESTERN RAILWAY CLUB.—W. L. Fox, executive secretary, Room 822, 310 South Michigan avenue, Chicago. Regular meetings, third Monday in each month, except June, July, August and September.

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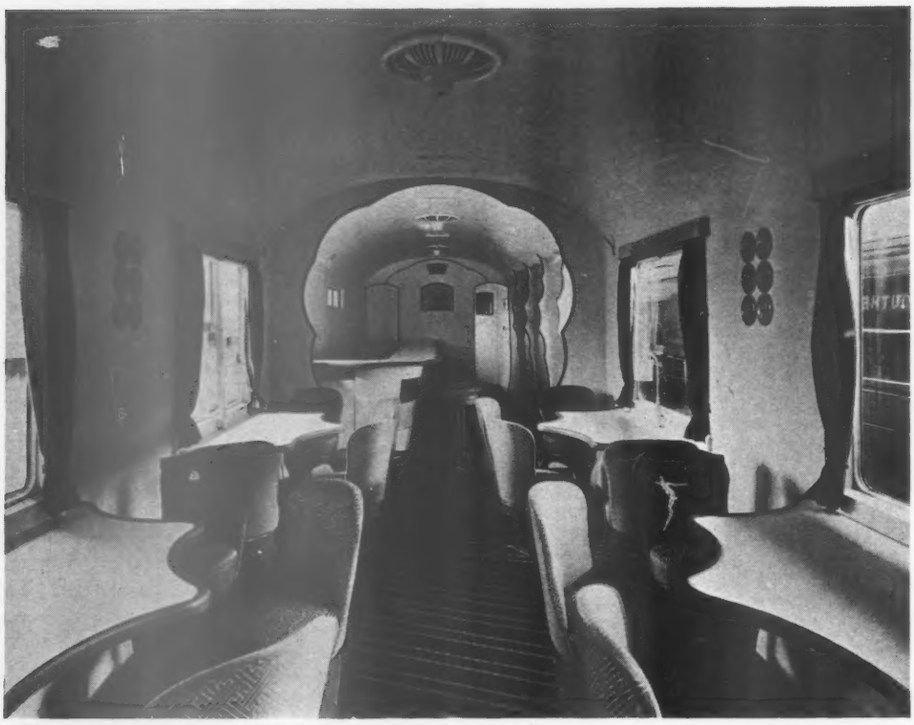

A buffet car for use on the electrified lines of the Southern Railway of England

NEWS

New Construction

THE Chicago & Eastern Illinois has awarded a contract to The Austin Company, Cleveland, Ohio, for the construction of the Oaklawn shops at Danville, Ill., a new coach shop 110 ft. by 417 ft. of brick construction with steel framework on a concrete foundation. The project will cost approximately $200,000.

Dismantling Program

THE Chicago, Rock Island & Pacific has under way a program for the dismantling of freight cars and locomotives which is being accomplished at the rate of 200 cars or more per month. During September, 295 freight cars and 4 locomotives were dismantled; during October, 448 freight cars and 18 locomotives; and during November, approximately 200 freight cars and 17 locomotives.

Equipment Building in Railroad Shops

The Missouri Pacific has completed the construction of 100 50-ton 45-ft. flat cars at its DeSoto, Mo., shops.

The Illinois Central is constructing 100 flat cars 52 ft. long and 10 ft. 4 in. wide in its shops at Centralia, Ill. The under-frames have been fabricated at the Nonconnah shops at Memphis, Tenn. Not including parts of 100 flat cars of smaller sizes that will be dismantled and used, the work will cost approximately $145,000.

1938 Mechanical Division Letter Ballot Results

IN Circular No. DV-940, issued under date of November 8, by the Association of American Railroads, Mechanical division, the results of the letter ballots on commendations of various committees reporting to the meeting of the General Committee at Chicago on June 29, 1938, are given in detail, a total of 78 individual propositions being involved. As a result of a favorable letter ballot all of these propositions to amend the standard and recommended practice of the division are approved effective March 1, 1939; with the exception of Propositions 4 (a) to 4 (aa), inclusive, covering definitions and designating letters which are approved effective immediately; and with the further exception of Propositions 9 to 55, inclusive, to amend the loading rules of the division which are approved effective February 1, 1939.

Roads Withdraw Wage Reduction

THE railroads have withdrawn their demand for a 15 per cent reduction in wages. By this action, taken at the annual meeting of the Association of American Railroads at Chicago on November 4, the railways will comply with the recommendation of the President's fact-finding committee.

The meeting at Chicago was called in response to President Roosevelt's request on October 31 for early advice regarding the attitude of the railway managements towards the findings of the emergency board. In a telegram sent to President Roosevelt in the afternoon, announcing the withdrawal of notices of wage reductions, J. J. Pelley, president of the Association of American Railroads, said in part:

"The railroads are taking this action, not because they agree with the conclusions reached by the board, but because they recognize the gravity of the situation, and because they hope that out of it there will come, through the co-operation of all concerned, a sounder and more equitable transportation policy in this country."

I. C. C. Expands Authorization For Use of Welded Tank Car

THE Interstate Commerce Commission, by Commissioner McManamy, has authorized the trial use of a glass-lined, two-unit, fusion-welded tank car for the transportation of water-white, electrolyte-grade (66 deg. Baume) sulphuric acid. The

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authority, carried in an order amending the order in No. 3666, Special Series A, dated September 4, 1935, does not involve the construction of the car; it merely expands the authorization as to the use of a car already built.

Bureau of Safety Accident Report

Of the total of 95 accidents reported by the Bureau of Safety, Interstate Commerce Commission for the period July, 1937, to July, 1938, 21 were attributed either wholly or in part, to roadway influences; 7 were laid to rail or switch failures, 4 to structure faults, 7 to landslides, rockslides or washouts and 3 to miscellaneous obstructions on track. Failures in rolling stock were cited as the cause of 9 accidents, and the contributing cause of 1 mishap. Such mechanical factors included 2 coupler failures, 3 truck and side clearance irregularities, 2 arch-bar truck breakdowns and 1 broken journal due to overheating.

Streamliners Make Money, Says Report

Reviewing in varying degrees of completeness the operation of some 76 high-speed "luxury" trains which have been introduced on American railroads in the last four years, Coverdale & Colpitts, consulting engineers, New York, conclude that "Every lightweight streamlined train operating in this country has produced additional passenger traffic and substantial earnings for the railroad placing it in service." In the 68-page report on "Streamline, Light - Weight, High - Speed Passenger Trains," which Coverdale & Colpits have prepared for the Edward G. Budd Manufacturing Company, Philadelphia, Pa., there are contained short histories of each train selected for treatment, classified by operating roads, details of the trains themselves, characteristics of their present routes, speed statistics, and, where obtainable, revenue and traffic figures.

The Denver "Zephyrs," of the Chicago, Burlington & Quincy, produced the highest ratio of earnings of any train of this type in the year ended June 30, 1938, the report shows. Building up a gross revenue of $2,088,938, these trains earned a net of $1,568,831, or 75.1 per cent of the gross and $2.07 per train-mile. Highest net revnues per train-mile were earned by the two "Daylights" of the Southern Pacific, operating between Los Angeles, Cal., and San Francisco, and the two "Hiawathas" of the Chicago, Milwaukee, St. Paul & Pacific, the report reveals, the former rolling up $3.211 per train-mile and the latter $3.217. In August, 1937, during the summer vacation season, the "Daylight" trains took in fares aggregating $6.28 per train mile. Of the long distance sleeping-car trains, the "City of San Francisco," operated by the Chicago & North Western, Union Pacific and Southern Pacific between Chicago and San Francisco, shows the highest net per train-mile—$2.529.

Chicago-Denver, Colo., runs appear to be the leaders in daily mileage. Each of the two "City of Denver" trains of the North Western-Union Pacific run 1,048 miles each day, while each of the Burlington's Denver "Zephyrs" cover 1,036 miles daily. The record for average speed seems to be held as well by the Denver "Zephyrs" for their 66 m.p.h. average speed on scheduled runs (one of these trains made a non-stop run of 1,017 miles from Chicago to Denver in 12 hours 12 min., at the average speed of 83.4 m.p.h. on October 23, 1936).

The Atchison, Topeka & Santa Fe, now possessing the largest fleet of streamline trains, actually had only one of these, the "Super Chief," in operation before the beginning of 1938, but these trains still produced $1,306,928 in gross revenue, with a net earning of $1.27 per mile. The ratio of net earnings to the gross was 61.3 per cent.

Of 28,395 passengers carried by the "Pioneer," "Twin," "Sam Houston" and "Ozark State" Zephyrs of the Burlington, 6,187, or 21.8 of the total, answered periodical questionnaires to the effect that they would have traveled by auto, bus or plane had not the Zephyr service been available. These and similar statistics not included on the report "prove conclusively that the new trains have induced a large number of persons to travel by rail who would not otherwise have done so."

The report pointed particularly to the growth of traffic on the Santa Fe's "Super Chief." The first new lightweight "Super Chief" was placed in service between Chicago and Los Angeles in May, 1937. In February, 1938, a second train was added to provide twice-a-week service. Revenue for the period January 1 to June 30, 1937, was $238,581; from July 1 to December 31, 1937, it grew to $306,286, and for January 1 to June 30, 1938, to $488,072.

In the report attention is called to the fact that the data are based wholly on records compiled by the accounting staffs of the respective railroads and that the information given therein, therefore, is authoritative. The items, however, are not entirely comparable one railroad with another. Overhead charges not directly apportionable to train operation—interest, depreciation, taxes and insurance—are omitted from the statements of revenues and expenses, also terminal rentals.

Representation of Shop Employees

Great Northern.—Some Great Northern shop employee groups voted for representation by organizations operating through the Railway Employees Department, American Federation of Labor, while others chose the Associated Organizations of Shop Craft Employees, Great Northern Railway, in recent elections conducted under the auspices of the National Mediation Board.

In one election covering the road generally the A. F. of L. unions were chosen by the machinists, blacksmiths, molders, electrical workers, the apprentices and helpers of the foregoing, and power house employees and shop laborers; Associated won the right to represent the boilermakers, sheet metal workers, and carmen (including coach cleaners), their apprentices and helpers. In a separate election held among employees of King Street station, Seattle, Wash., the Associated was chosen by the machinists, sheet metal workers (including molders), electrical workers, and carmen (including coach cleaners), and the apprentices and helpers of the foregoing; A. F. of L. unions won among the power house employees and shop laborers, while in the craft of blacksmiths, their apprentices and helpers no certification was made for the reason that

New Equipment Orders and Inquiries Announced Since the Closing of the November Issue

Locomotive Orders

Company	No. of Locos.	Type of Loco.	Builder
Kansas City Terminal	1	900-hp. Diesel-electric	American Loco. Co.
	2	Diesel-electric switch	Electro-Motive
Seaboard Air Line	1‡	Diesel-electric	Electro-Motive
Sorocabana Railway	4*	4-10-2	American Loco. Co.
White Pass & Yukon Route	1†	2-8-2	Baldwin Loco. Wks.

Locomotive Inquiries

Columbus & Greenville	5	2-8-2	.....
Reading-Central of New Jersey	15§	Diesel-electric	.....

Freight-Car Orders

Road	No. of Cars	Type of Car	Builder
Cornwall Railroad	20	75-ton ore cars	Bethlehem Steel Co.
Bessemer & Lake Erie	100	Flat	American Car & Fdry. Co.
Illinois Central	1,000	Box	American Car & Fdry. Co.

Freight-Car Inquiries

Norfolk & Western	1,500	55-ton hopper	.....
	600	50-ton box	.....
Wheeling & Lake Erie	400	60-ton hopper	.....

Passenger-Car Orders

Road	No. of Cars	Type of Car	Builder
Seaboard Air Line	1‡	Dining	Edw. G. Budd Mfg. Co.
	6‡	Chair	Edw. G. Budd Mfg. Co.
Southern	25	70-ft. express¶	Bethlehem Steel Co.

Passenger-Car Inquiries

Temiskaming & Northern Ontario	1	Rail motor car	.....

* Meter-gage, three-cylinder 4-10-2 locomotives.
† Total engine weight about 72½ tons; 17-in. by 22-in. cylinders; driving wheels, 44 in. in diameter.
‡ The locomotive and seven cars will comprise one train of stainless steel streamlined.
‡ The locomotive will be equipped with two 1,000 hp. General Motors Diesel engines.
§ Purchase authorized.
¶ Subject to the approval of the I. C. C.

no organization or individual received a majority vote.

Virginian.—Labor organizations affiliated with the Railway Employees' Department, American Federation of Labor, won recent elections supervised by the National Mediation Board on the Long Island and the Washington Terminal while the Brotherhood of Railroad Shop Crafts of America, Virginian System, was chosen in a third contest by the Virginian's carmen (including coach cleaners), their helpers and apprentices.

As a result of the election on the Long Island, the International Association of Machinists has been designated to represent machinists while the International Brotherhood of Firemen, Oilers, Helpers, Roundhouse & Railway Shop Laborers was chosen by the power house employees and railway shop laborers.

Equipment Depreciation Orders

EQUIPMENT depreciation rates for 21 railroads are prescribed by the Interstate Commerce Commission in a new series of sub-orders and modifications of previous sub-orders in No. 15,100 Depreciation Charges of Steam Railroad Companies. The composite percentages, which are not prescribed rates, range from 3.03 for the Texas & New Orleans to 11.61 for the Osage. Also included among the 21 roads are the Cheswick & Harmar; the Sumpter Valley; the Akron, Canton & Youngstown; St. Joseph Terminal; New York, Chicago & St. Louis; Alton; Chicago, Indianapolis & Louisville; and Grand Trunk Western.

The above-mentioned 3.03 composite percentage for the Texas & New Orleans is derived from prescribed rates as follows: Steam locomotives (both owned and leased), 2.76 per cent; other locomotives, 9.46 per cent; freight-train cars (owned), 3 per cent—leased, 3.36 per cent; passenger-train cars (owned), 2.47 per cent—leased, 2.72 per cent; light-weight streamlined passenger-train cars (leased), 3.84 per cent; work equipment (owned), 3.72 per cent—(leased), 3.32 per cent; miscellaneous equipment, 10.35 per cent.

The A. C. & Y.'s composite percentage is 4.03; its prescribed rates: steam locomotives, 3.55; freight train cars, 5.69; passenger train cars, 3.83; work equipment, 3.61; and miscellaneous equipment, 17.96.

The Nickel Plate's composite percentage of 3.93 is derived from the following prescribed rates: Steam locomotives, 3.8 per cent; freight-train cars, 4.04 per cent; passenger-train cars, 3.1 per cent; work equipment, 4.43 per cent; miscellaneous equipment, 6.95 per cent. The Alton's composite percentage of 4.34 is derived from the following prescribed rates for owned and leased equipment, respectively: Steam locomotives, 5.09 per cent and 2.78 per cent; other locomotives (leased), 6.63 per cent; freight-train cars, 4.79 per cent and 2.5 per cent; passenger-train cars, 3.79 per cent and 2.74 per cent; work equipment, 3.23 per cent and 6.93 per cent; miscellaneous equipment (owned), 13.33 per cent.

The Monon's composite percentage is 3.67; its prescribed rates are as follows: Steam locomotives, 2.78 per cent; freight-train cars, 4.23 per cent; passenger-train cars, 2.87 per cent; work equipment, 3.92 per cent; miscellaneous equipment, 14.98 per cent. The Grand Trunk Western's composite percentage of 3.23 is derived from the following prescribed rates for owned and leased equipment, respectively: Steam locomotives, 3.28 per cent and 2.78 per cent; other locomotives (owned), 6.5 per cent; freight-train cars, 3.37 per cent and 3.11 per cent; passenger-train cars, 3.87 per cent and 3.16 per cent; work equipment (owned), 3.5 per cent; miscellaneous equipment (owned), 9.67 per cent.

The statement also lists Sub-order No. 189-A, which vacates Sub-order No. 189, dated June 17, 1935, relating to the Charlotte, Monroe & Columbia.

Supply Trade Notes

HOWARD G. HILL, sales and service engineer of the Miller Felpax Company, Winona, Minn., has been appointed mechanical engineer, in addition to his other duties.

◆

WATER JEHU, general manager of the Timken Roller Bearing Company, Ltd., Toronto, Ont., has been appointed district manager of the Timken Roller Bearing Company, with headquarters at Boston, Mass.

◆

THE CHICAGO RAILWAY EQUIPMENT COMPANY, Chicago, has entered into a contract with the Pullman-Standard Car Manufacturing Company whereby it will take over all Pullman patents covering car doors and door fixtures.

◆

HARRY L. FREVERT has been elected a member of the board of directors and the executive committee of The Baldwin Locomotive Works, to fill the vacancies caused by the resignation of George H. Houston recently. Mr. Frevert is president of The Midvale Company.

◆

THE BETHLEHEM STEEL COMPANY has recently completed a large expansion and modernization program at its Johnstown, Pa., axle plant. This includes additional equipment in the forging and heat-treating departments and an entirely modern axle-finishing shop. In the forging department the equipment includes an additional forging hammer and a charging machine. There are two new modern heat-treating furnaces. The axle-finishing shop is housed in a building having brick walls with large steel sash and saw-tooth roof. The floor is concrete with the surface hardened to withstand heavy trucking and prevent dusting, and wood blocks have been laid in front of all machines. There is a battery of cutting-off and centering machines; center-driven axle lathes, each having two tools at each end to permit the employment of a very slow feed without sacrifice of production; a battery of end-driven lathes for overall finishing, where required; boring mills with a capacity of 6-in. holes 126

(*Continued on second left-hand page*)

Inspecting axles on the shipping bed at the Johnstown, Pa., plant of the Bethlehem Steel Company

NEW HIGH RE

GM
DIESEL POWER

Railroads using EMC Diesel Switchers have definitely proved these clear-cut economies . . .

- Fuel costs normally reduced 75 per cent.
- Maintenance costs reduced 50 per cent.
- Enginehouse expenses, including lubricants, water, supplies,—reduced 66 per cent.
- Availability for service averages 94 per cent.
- Uniform efficiency throughout entire year.
- Safer and faster operation through better visibility—absence of smoke and steam—higher initial tractive effort.
- Elimination of fire hazard and smoke complaints.
- Less track wear and fewer derailments.
- Combined tangible savings normally sufficient to liquidate the Diesel's first cost in 5 years.

ELECTRO-MOTIVE C

SUBSIDIARY OF GENERAL MOTORS L

RECORDS for

Economy

● THE Rock Island now has 37 EMC Diesel Switchers in service . . . Each Switcher is saving $1,000.00 per month over and above carrying and amortization charges . . . Operating at an availability of 98 per cent, these 37 EMC Diesels have replaced 80 steam switchers . . .

CORPORATION

LA GRANGE, ILLINOIS, U. S. A.

in. long, and a grinding machine for overall finishing of axles for high-speed passenger equipment. The machines are served by overhead monorails with electric hoists, and the shipping bed adjoining the machine tools is served by an overhead crane. There is a stock yard with a storage capacity of about 1,500 tons.

◆

L. F. KINDERMAN, formerly associated with the Republic Steel Corporation and the Westinghouse Electric & Manufacturing Company, has been appointed district sales representative for the Cleveland-Pittsburgh territory of Iron & Steel Products, Inc., Chicago, with headquarters in Warren, Ohio.

◆

DR. A. GIESL-GIESLINGEN, who for some years has been serving as a consulting engineer in the United States, has returned to Austria as assistant sales manager of the Wiener Locomotiv Fabrik—A. G. Vienna. Dr. Giesl first came to the United States in October, 1929. He was connected with the Western Railway Equipment Company, St. Louis, Mo., doing special engineering work from 1930 to 1933. Since 1933 he served as consulting engineer for various companies.

◆

THE OWENS-ILLINOIS GLASS COMPANY and the Corning Glass Works have formed the Owens-Corning Fiberglas Corporation which will produce a variety of products made from fiber glass. These products will be marketed in such fields as household equipment, building construction, refrigeration insulation, air filters, and electric-power insulation, fields previously dominated by organic textiles and other materials. The products and processes are protected by basic patents.

The Gustin-Bacon Manufacturing Company, who in the past have been affiliated with the Owens-Illinois Glass Company in the distribution of Fiberglas products to the railroad industry, will act in the same capacity for the Owens-Corning Fiberglas Corporation.

The new corporation, the Owens-Corning Fiberglas Corporation, is financed jointly by Owens-Illinois and Corning and is an independent corporate structure which will not operate as a subsidiary of either parent company. The officers are: Chairman of the board, Amory Houghton, who is also president of the Corning Glass Works; president, Harold Boeschenstein, who has resigned as vice-president and general manager of the Owens-Illinois Glass Company; vice-presidents, Games Slayter, who has played a major part in the development of the new basic product, and W. P. Zimmerman, formerly general manager of the industrial products division of Owens-Illinois; general sales manager, G. E. Gregory, former sales manager of Corning; secretary, A. C. Freligh, former comptroller of fiber glass products of Corning; comptroller, H. R. Winkle, formerly assistant comptroller of Owens-Illinois. The principal offices of the company are at Toledo, Ohio. The New York offices are at 718 Fifth avenue. Other sales offices will be located at Boston, Mass.; Washington, D. C.; Chicago; Detroit, Mich.; Pittsburgh, Pa.; Cincinnati, Ohio, and San Francisco, Calif.

Amory Houghton was born on July 27, 1899, at Corning, N. Y. He was educated at St. Paul's School, Concord, N. H., and

Amory Houghton

Harvard University. After receiving his A. B. degree at Harvard in 1921 he entered the service of the Corning Glass Works. He was made assistant to the president in 1926 and became executive vice-president in 1928. He was elected president in 1930.

Harold Boeschenstein was born on July 21, 1896, at Edwardsville, Ill. He was educated at the University of Illinois,

Harold Boeschenstein

from which he received the degree of B.S. in 1920. He joined the Illinois Glass Company at Alton, Ill., in 1921, and the Owens-Illinois Glass Company in 1930 when the Owens Bottle Company and the Owens Glass Company were merged.

◆

WILLIAM S. JOHNSON, district manager of the American Car and Foundry Company, Berwick, Pa., retired at his own request on December 1. Mr. Johnson completed 53 years service in the employ of the American Car and Foundry Company, and its predecessor, during the last 17 of which he was in full charge of the Berwick district. He started his career in the rolling mill of the Jackson & Woodin Co., which later merged with other independents to form the American Car and Foundry Company. He rose through various steps until he reached the district managership on May 1, 1921. Guy C. Beishline has been appointed district manager in charge of the Berwick district, vice Mr. Johnson. Mr. Beishline began his career with the American Car and Foundry Company, but resigned in 1914 to join the Mt. Vernon Car and Manufacturing Co. In the course of 20 years he rose to the position of plant manager, vice-president and director. In 1937 he rejoined the American Car and Foundry organization as a special assistant on the staff of the vice-president in charge of operations, from which he is now promoted to the district managership.

◆

THE DIVISION OF ENGINEERING AND RESEARCH of the Crane Company held open house to several hundred scientists, educators, research men, engineers, business executives, and magazine and newspaper editors at the research and testing laboratories of the company at Chicago. The occasion of the event was the completion of an ambitious program of enlargement and extension of the company's laboratory facilities. This program of development has been carried forward under the general direction of L. W. Wallace, director of the Engineering and Research division, and formerly director of engineering research of the Association of American Railroads.

◆

THE ELECTRO-MOTIVE CORPORATION, a subsidiary of General Motors, has completed a 300,000 sq. ft. addition to its Diesel locomotive plant at La Grange, Ill. The addition increases the manufacturing area two-thirds, bringing it to a total of about 14 acres, and brings under one roof complete facilities for the fabrication of Diesel-electric switching and passenger locomotives, with the exception of certain castings and forgings which may be purchased more economically from outside sources due to the variety of their sizes and shapes.

The enlargement is the second since the plant was opened in January, 1936. Employment has increased to 2,000 from an original working force of 350. A total of 225 locomotives, developing an aggregate of 210,000 hp. has been turned out of the plant to date, the total value of these locomotives together with spare parts manufactured for stock, being $25,000,000. As enlarged and equipped, the plant now has a maximum capacity of one complete locomotive per working day.

Obituary

SAMUEL G. REA, vice president in charge of sales in the Eastern district, of the Standard Railway Equipment Company, Chicago, with headquarters in New York, died in that city on November 16.

◆

GEORGE THOMAS COOKE, president of the American Railway Products Company, Darien, Conn., died on November 8.

◆

CHARLES C. KINSMAN, assistant to the president of the Universal Draft Gear Attachment Company, Chicago, died suddenly on November 14 at his home in Chicago. He was a graduate of the Massachusetts Institute of Technology and had been with the company for 27 years.

Personal Mention

General

C. F. SPICKA, superintendent of shops on the Union Pacific at Cheyenne, Wyo., has been promoted to acting assistant general superintendent of motive power and machinery of the Eastern district, with headquarters at Cheyenne.

CLYDE BERTRUM HITCH, who has been appointed superintendent of motive power of the Chesapeake & Ohio at Richmond, Va., as noted in the November issue, was born at Terre Haute, Ind., on November 19, 1881. After serving his apprenticeship on the old Vandalia Line (now a part of the Pennsylvania) at Terre Haute, he

Clyde Bertrum Hitch

found employment as a machinist on various roads, entering the service of the C. & O. on September 1, 1902, as a machinist at Lexington, Ky. On April 1, 1909, Mr. Hitch was promoted to the position of general foreman, serving in this capacity successively at Lexington, Covington, Ky., and Hinton, W. Va. He was appointed master mechanic of the Clifton Forge division on January 1, 1921, and in November, 1923, became master mechanic of the Cincinnati division, including the Northern sub-division. In February, 1930, his headquarters were transferred to Russell, Ky., thus extending his jurisdiction over the Russell Terminal and the Ashland and Big Sandy divisions. He became general master mechanic, western general division in May, 1930, and in September, 1931, his jurisdiction was extended to the eastern general division. On January, 1934, he was appointed assistant superintendent of motive power at Huntington, W. Va.

JOHN GOGERTY, assistant general superintendent of motive power and machinery of the Eastern district of the Union Pacific, with headquarters at Cheyenne, Wyo., has been transferred to Pocatella, Idaho, with jurisdiction over the South-Central and Northwestern districts.

Master Mechanics and Road Foremen

E. A. SCHRANK, master mechanic on the Chicago, Burlington & Quincy at Galesburg, Ill., has been transferred to Casper, Wyo., succeeding William Schwartz, who returned to his former position as enginehouse foreman at that point.

C. D. ALLEN, has been appointed assistant master mechanic of the Chesapeake & Ohio at Clifton Forge, Va.

J. E. MCLEOD, assistant master mechanic on the Chesapeake & Ohio at Stevens, Ky., has been transferred to Peru, Ind.

FRANK J. TOPPING, assistant master mechanic of the Chesapeake & Ohio, with headquarters at Hinton, W. Va., has been transferred to Stevens, Ky.

F. J. CARTY, master mechanic of the Boston & Albany, with headquarters at Boston, Mass., was born on January 10, 1882, at Boston. He attended Boston public schools, and is a graduate of Mechanic Arts High School (1899). He took a post graduate course; and in 1904 received a B.S. degree in mechanical engineering from the Massachusetts Institute of Technology. Mr. Carty entered the employ of the Boston & Albany on November 7, 1904, as a draftsman in the office of the superintendent of motive power and vice-presi-

F. J. Carty

dent at Boston. He became mechanical engineer of the B. & A., on October 26, 1907, and master mechanic in October, 1938. Mr. Carty was president of the New England Railroad Club from March, 1926, to March, 1927.

STANLEY M. HOUSTON, newly appointed master mechanic of the Southern Pacific at Oakland, Calif., was born at Albuquerque, N. M., on June 5, 1898. He was educated in the public schools in Arizona and took a four-year night course in mechanical engineering. Mr. Houston entered the employ of the Southern Pacific on April 1, 1913, as a machinist apprentice at Globe, Ariz. Upon the completion of his apprenticeship in May, 1917, he served at Globe until April, 1920, as a machinist; until April, 1922, as enginehouse foreman; until April, 1923, as general foreman; and until October, 1924, as master mechanic. In the latter year he was appointed superintendent of general shops of the Southern Pacific of Mexico with headquarters at Empalme, Sonora, Mex. In July, 1927, he became superintendent of motive power at Sonora,

Stanley M. Houston

and in April, 1936, was transferred to Guadlajara Jalisco, Mex., as assistant general manager. He returned to the United States in May, 1937, as assistant master mechanic of the Southern Pacific at Oakland, Calif.

Obituary

JULIUS H. REISSE, retired mechanical assistant to the executive vice-president of the Chicago, Burlington & Quincy, died at Chicago on November 3, following a long illness. Mr. Reisse was born on October 14, 1880, and studied mechanical engineering through the International Correspondence Schools. After serving with the Pullman Company from 1899 to 1905, he entered the service of the Burlington in the latter year as a draftsman at Aurora, Ill.,

Julius H. Reisse

later being transferred to Chicago. In December, 1905, he was appointed leading draftsman, and in May, 1918, was advanced to chief draftsman. Mr. Reisse became mechanical inspector in May, 1925, and on March 4, 1926, was appointed mechanical assistant to the vice-president, retiring from the latter position in May, 1936.

December
1938

Railway Mechanical Engineer

FOUNDED IN 1832

Rod Bushings Machined Almost As Fast As You Can Peel APPLES

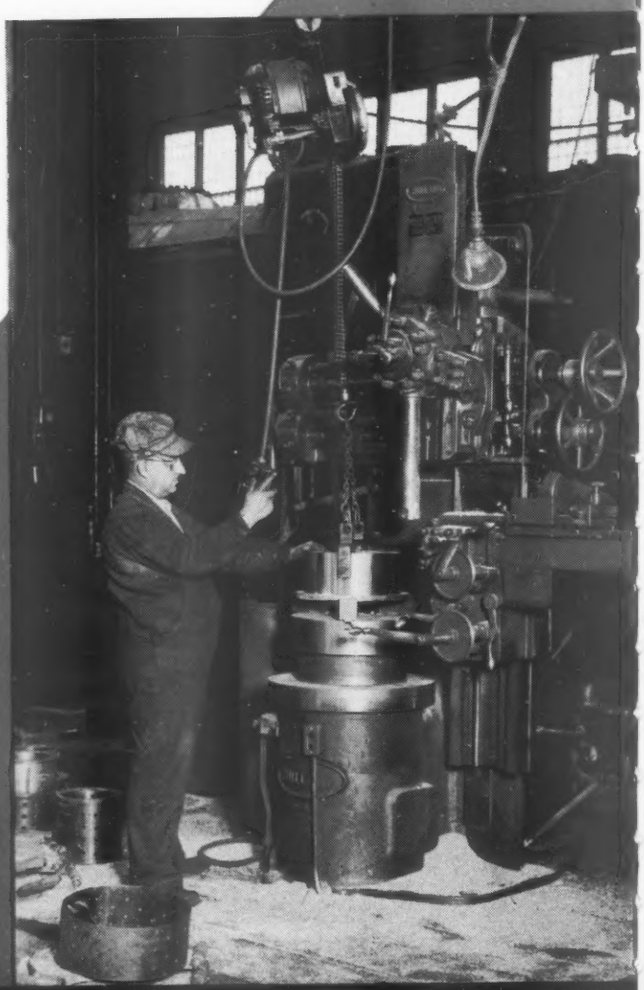
ONLY takes a moment to check—150 r.p.m. x .042 in. feed = 6 inches of machined surface per minute.

Now—let's check the time on the job illustrated on this page—floating rod bushing 13½" o.d. x 10⅜" i.d. x 6" with 1½" flange—rough boring cut = 3/32" rough turning cut — ⅛"—feed and speed as mentioned above.

Total floor to floor time including chucking, boring, turning, facing top, facing the flange, checking with template and removal requires just 3 min. and 10 seconds.

Finish cuts are not taken until the grease holes have been drilled and counter-sunk. The unit is a special 24" V.T.L. built to railroad specifications and equipped with a pneumatic chuck.

The new BULLARD Standard High Speed Vertical Turret Lathes offer unusual opportunities of reducing repair costs. The 24 in. size has table speeds ranging from 7.65 to 250 r.p.m. Ask Bullard engineers for detailed information on this machine.



BULLARD

R.R. SHOP UNITS

THE BULLARD COMPANY

BRIDGEPORT, CONNECTICUT

Vol. 112 No. 12

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U·S·S Locomotive Frames of

For New Power

Eight U·S·S Rolled Steel Frames going into car bottom type furnace for heat treatment. Note that extra metal left on frames, from which test pieces are taken, receives same treatment as frames.

CASE No. 1. A New Texas Type Locomotive

Weights, in working order:—

On driving wheels	*369,100 lb.*
On engine truck	*38,300 lb.*
On trailer truck	*112,600 lb.*
Locomotive and Tender	*903,900 lb.*

EACH of the U·S·S Frames for these locomotives was made from a single rectangular plate of wrought and rolled carbon steel—6½" x 36¾" x 438½"—weighing 24,675 lb.

To insure the greatest possible homogeneity and strength, the steel was converted from ingots into slabs by two separate rollings—sufficient discard was taken from each ingot and slab to insure freedom from piping and undue segregation—slab was then heated and rectified for flatness. Gas cutting to frame contour was performed with the slab held at approximately 600°F.

After cutting, frames were put through three heat treating cycles consisting of a double normalizing and temper, again rectified and tested to meet following minimum physical properties:—

Yield Point	Tensile Strength	Elong. in 2"
40,000 lb. p.s.i.	75,000 lb. p.s.i.	25%

Red. of Area	Cold Bend
45%	180°—D ½"

These physical properties are uniform throughout entire frame.

The frames—6½" thick, weighing 13,230 lb. each, were planed to 6" thickness, slotted, drilled and fitted by locomotive builder.

• • •

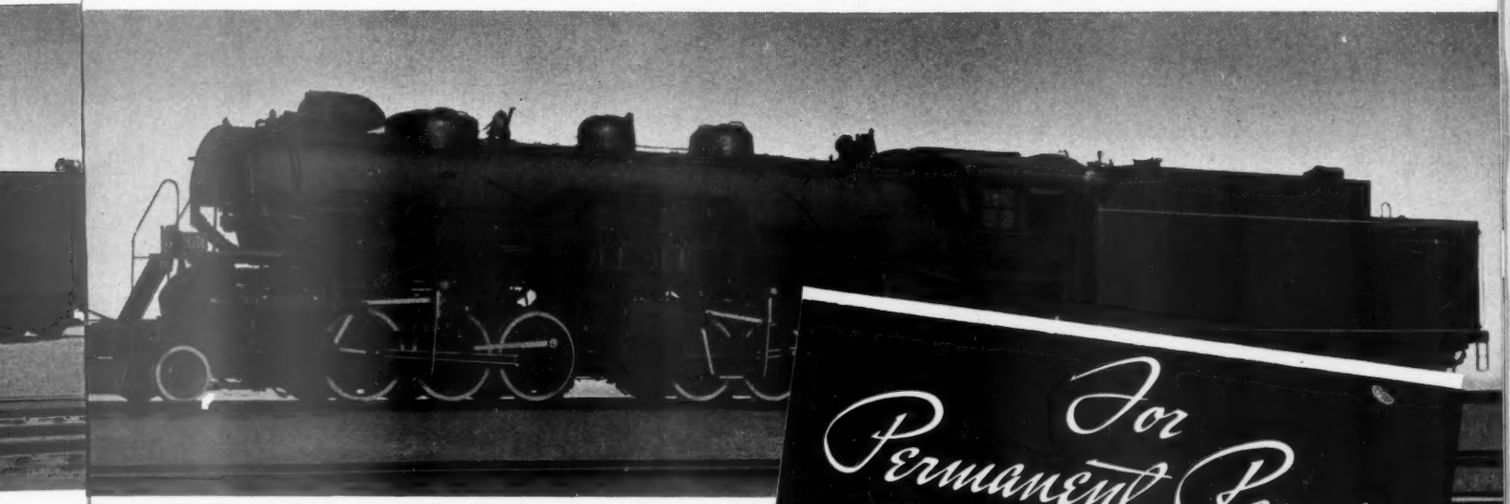
Here's what the Superintendent of Motive Power says about them. ***"These locomotives with U·S·S Rolled Steel Frames have been in service since early in 1937 and have given complete satisfaction, with 100% availability for service. No defects have developed. We have encountered no loose bolts or fastenings and have reason to believe the frame construction satisfactory in every respect."***

These 6 advantages distinguish U·S·S Rolled Steel Locomotive Frames

1. *Low first cost*, especially where only a few locomotives are built or when cylinders or frames are renewed—because no expensive patterns or molds are necessary.
2. *Low maintenance charges* throughout the life of the locomotive—due to the practical elimination of repairs and renewals on account of failure.
3. *Less weight* due to the fact that the superior physical qualities of rolled steel make it possible to reduce section with safety.
4. *Greater margin of safety* and durability as a result of the inherent superiority of rolled steel which is free, throughout, from imperfections and possesses a high degree of homogeneity.
5. *Less rigidity*—greater flexibility to safely absorb shocks, impacts, weave and vibration.
6. *Ease of installation* of part-frame sections when existing frames are renewed or repaired.

U·S·S LOCOMOTIVE FRAMES

of *Rolled* OPEN-HEARTH Steel



For Permanent Repairs

CASE No. 2. A Re-framed Mallet Type Locomotive

Weights, in working order:—

Locomotive and Tender ..... *739,000 lb.*
Locomotive ..... *390,300 lb.*

THE four rectangular plates furnished for this typical major repair were of nickel steel, S.A.E. 2035—5½″ x 34″ x 276″—total weight, 59,357 lb. Double converted—sufficient discard removed—put through three heat treating cycles—rectified for flatness and tested to meet the following minimum physical properties:—

Yield Point	Tensile Strength	Elong. in 2″	Red. of Area
55,000 lb. p.s.i.	80,000 lb. p.s.i.	25%	50%

These physical properties are uniform throughout entire plate.

Plates were delivered to the railroad shop where they were gas cut to contour, stress relieved at temperature below final draw which left physical properties undisturbed, then planed to 5″ thickness and finish machined. Photomicrographic tests proved that heat penetration on cut surfaces did not exceed ¼″. No slotting necessary on weight saving openings. Therefore, *no extra machining costs.*

For re-framing locomotives we will furnish:—

1. Rectangular plates, heat treated as described above.
2. Frames, either full length or in section, gas cut to contour with stock allowed for finish machining.
3. Frames, gas cut and finish machined.
4. Frames, gas cut and finish machined, with pedestal binders and all attachments, ready for installation under locomotives.

Gas cutting U·S·S Locomotive Frame from solid steel plate. Metal template guides "Travograph" in cutting exact size required.

CARNEGIE-ILLINOIS STEEL CORPORATION

Pittsburgh · Chicago

Columbia Steel Company, San Francisco, *Pacific Coast Distributors* · United States Steel Products Company, New York, *Export Distributors*

USS

UNITED STATES STEEL

They wanted light weight-strength

50-TON BOX CAR—LIGHT WEIGHT 37,500 LB. **Has all-welded underframe, ends, doors, sides and roof, assembled on jigs by both fusion and spot welding—then joined together by fusion welding. (Riveted if desired). COR-TEN has been used to the fullest extent practicable—the thickness of plates and shapes being reduced to a minimum consistent with adequate strength and long life.**

. . . so of course

a.c.f. engineers know a lot about U·S·S COR-TEN. Ever since this pioneer low-alloy, high tensile steel was first put on the market, American Car and Foundry Company has used COR-TEN to improve and modernize transport equipment of all kinds. They've used it in hopper cars—in refrigerator cars—in rail cars, street cars, subway cars and in complete streamliners such as the later "Rebel" trains, and the famous "Abraham Lincoln."

They know what COR-TEN will do—how easily and economically it fabricates—how little it costs—and how well it stands up in service. They've watched it perform on all kinds of equipment—

ALL WELDED REFRIGERATOR CAR ROOF. **U·S·S COR-TEN used throughout, turtle-back roof is assembled as a unit as shown. Side plate is an angle with vertical leg formed to a large radius. Roof sheets of 18-gauge COR-TEN extend from side to side, have lap joint on every carline, are spot welded to the side plate angle, carlines, purlines and end plates. The 3/32" carlines are spaced on 3'4" centers. After complete assembly, roof is riveted to car sides and ends—may be welded if desired.**

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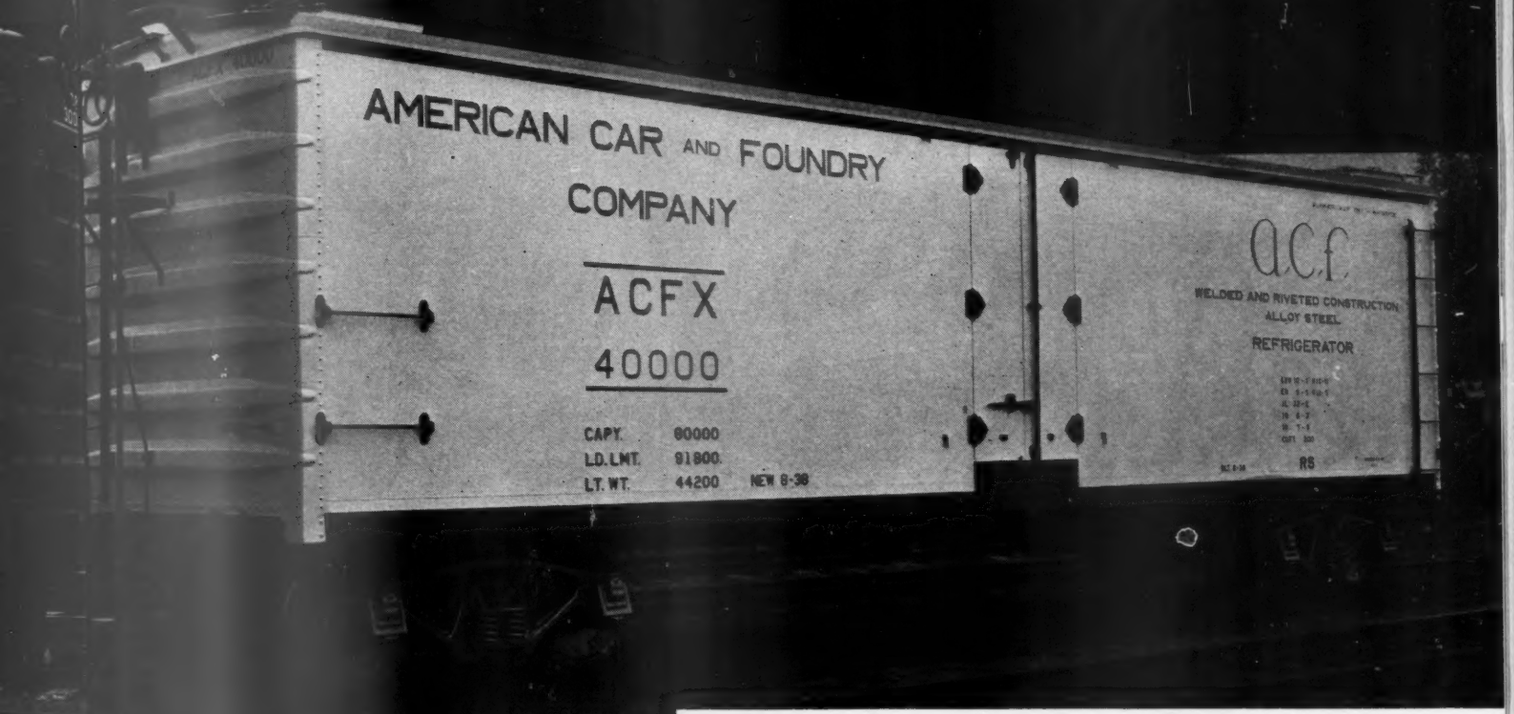

40-TON REFRIGERATOR CAR—LIGHT WEIGHT 44,200 LB. **As in the box car, U·S·S Cor-Ten is used throughout the body except center sills. Built for welding sub-assemblies on jigs—these are assembled by riveting, though they can be assembled by welding if desired. New developments include ice bunker, ice hatch, removable steel bulkhead, a unique and very efficient application of insulation, and a new, economical method of using dry ice in combination with water ice.**

...e they chose COR-TEN!

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they have seen it justify every claim made for it.

So when they built these new light-weight, all-welded box and welded-riveted refrigerator cars, they naturally turned to U·S·S Cor-Ten.

Taking advantage of the high strength and high corrosion resistance of Cor-Ten, a.c.f. designers trimmed tons of dead weight off the body structure—without sacrificing strength or stamina. In the box car, re-design using Cor-Ten construction shows 7,800 lb. saving in weight compared to the conventional riveted A.A.R. car—with equivalent increase in payload capacity. Its ratio of lading to rail load is 77.8% instead of 73.1% The new refrigerator car is 8,600 lb. lighter than a similar capacity, riveted, light car built only two years ago. And in this construction, the fact that Cor-Ten, under combined atmospheric and brine-spray conditions, is twice as effective in resisting deterioration as copper steel, definitely assures low maintenance.

If you want to modernize your equipment—reduce its weight—increase its payload capacity—minimize operating and maintenance costs—build with Cor-Ten. Adaptable to modern, high-speed methods of fabrication, Cor-Ten can be handled as successfully as ordinary steel. We'll be glad to show you where and how best to use it.

U·S·S HIGH TENSILE STEELS

and Chicago
NY, Birming
tors

UNITED STATES STEEL

THE BALDWIN LOCOMOTIVE W

50 years ago

Fifty years ago the late F. W. Sargent, for many years Chief Engineer of this company, designed and built the first brake shoe testing machine.

Thirty years ago we placed our first full scale brake shoe testing machine in operation. This machine, modified and improved, was the point from which notable brake shoe improvements began.

Laboratories, both metallurgical and physical, have been built and, recently, we placed in operation a new and specially designed brake shoe testing machine. This machine has a capacity and sensitivity far greater than any other built up to this time. With this highly specialized equipment, brake shoe research will continue in order to anticipate the needs of tomorrow.

Notable recent improvements made by our Engineering Department are—

1. Samson reinforcement for driver shoes—to hold the body metal of the shoe intact until worn out.
2. An improved method of protecting steel backs and inserts from burning by the molten iron in manufacture.
3. The Duplane reinforcement for freight shoes—to eliminate premature failure of brake shoes in freight service.
4. The Brake Shoe LOCKEY—to prolong brake head life and minimize breakage and loss of car shoes in freight car service.

Write to 230 Park Avenue, New York, N. Y., for brochure of the new brake shoe testing machine.

THE AMERICAN BRAKE SHOE AND FOUNDRY COMPANY

BRAKE SHOE AND CASTINGS DIVISION

DRIVING POWER MEETS

Like washing an elephant, cleaning a locomotive is a big job. It calls for a metal cleaner with unusual qualities.

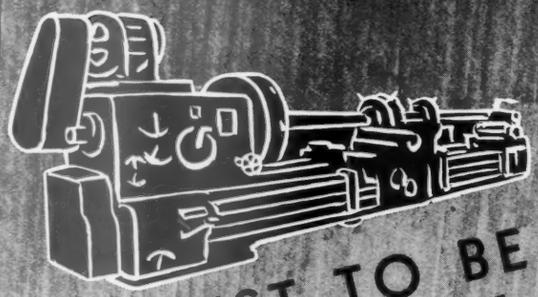
Wyandotte Engine Washing Compound will tackle a very big engine, cab, tank, jacket—as well as running gear—at *very small cost.* Because it does not *attack* the *finish*, because it leaves a *bright dry* surface that won't pick up road dirt—because a little goes a long way—railroads are switching their engines onto the Wyandotte cleaning track.

And they are on the right track. There are several Wyandotte Metal Cleaners—each one is built for a specific job—each one will save you money. A call to your Wyandotte Service Representative will bring an answer to your railway-cleaning problems.

THE J·B·FORD COMPANY

WYANDOTTE MICHIGAN

DISTRICT OFFICES IN 26 CITIES



JUST TO BE DIFFERENT we give HALF this page to YOU!

It's the popular custom to show a picture of a tool, glorify its virtues, quote its percentages of savings and hope to heaven that the impression will encourage an inquiry. Just this once we want to be different. We show the picture merely to indentify that LeBlond makes good Lathes. The rest of this space we turn over to you.

You tell us about your problems!—What your present lathe operations are!—What you think you'd like to accomplish in performance, precision, cost reduction! If what we make fits into your picture, we'll tell you how and why...but only at your request. If you like, you can tell us what your experience has told you about LeBlond Lathes. That's up to you. It's your turn now. This is on us. Shoot!

The R. K. LeBlond Machine Tool Co.
CINCINNATI, OHIO

THE SPACE BELOW BOUGHT AND PAID FOR BY LeBLOND FOR YOUR EXCLUSIVE USE

Dept. I-14

Add to the HEALTHFULNESS *and* APPEAL

OF RAILWAY TRAVEL

...with ULTRA-VIOLET RAYS and *VITALIZED AIR CONDITIONING*

EVERY RAILROAD is up against the problem of cutting expenses. An opportunity to reduce costs and secure greater health and comfort for railway travel is worth investigating. And here it is... VITALIZED AIR CONDITIONING, with ultra-violet sterilization.

In a few words, Sturtevant *Vitalized* Air Conditioning is the automatic and economical treatment of air, to render it more livable, more like the air of the woodland and the sea—and Ultra-Violet Rays contribute to this result.

For cars equipped with mechanical refrigeration, *Vitalized* Air Conditioning means that 100% outdoor air can be circulated under automatic wet bulb temperature control—without overloading the existing compressor-condenser system. It also means lower maintenance, through less frequent starting and stopping of the compressor.

For cars equipped with ice cooling systems, it means satisfactory regulation of evaporative cooling—with resulting savings in ice consumption.

For *every* conditioned car regardless of cooling system, Vitalized Air Conditioning means:

1. ***Safer air***—treated by the action of the water sprays or ultra-violet rays.
2. ***Vitalized air***—"revigorated" to give it that pleasing, mellow quality associated with outdoor air.
3. ***Cleansed air***—washed and filtered to remove dirt, dust and odors.

We invite you to investigate Vitalized Air Conditioning.

Sturtevant RAIL VANE UNITS OR SYSTEMS

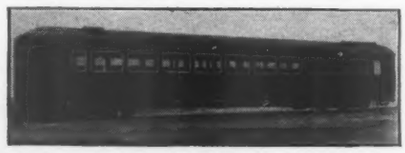
Sturtevant "Railvane" Units or Systems are used by 37 railroads. "Railvane" Air Conditioning is protected by 30 issued patents and other patents pending.

BANGOR & AROOSTOOK COACH INTERIOR

The Sturtevant Ultra-Violet Sterilizer is located directly over the recirculated air grille, to be operated in winter when the sprays are not in service. With this equipment, the benefits of ultra-violet treatment of air have been demonstrated in railway cars after a year of actual operation.

Regular equipment may be provided which will produce no perceptible quantity of ozone.

But when the presence of the small quantities of ozone found in mountain air is desired, special ultra-violet lights may be provided in combinations to meet any desired standards.



B. F. STURTEVANT COMPANY
HYDE PARK, BOSTON, MASS., *Branches in 40 Cities*
B. F. Sturtevant Company of Canada, Ltd.
Galt, Toronto, Montreal

FOR 28 YEARS... PIONEERS IN AIR CONDITIONING

TIMKEN Bearings Lengthen Driving Wheel Tire Life

REDUCE TIRE TURNING

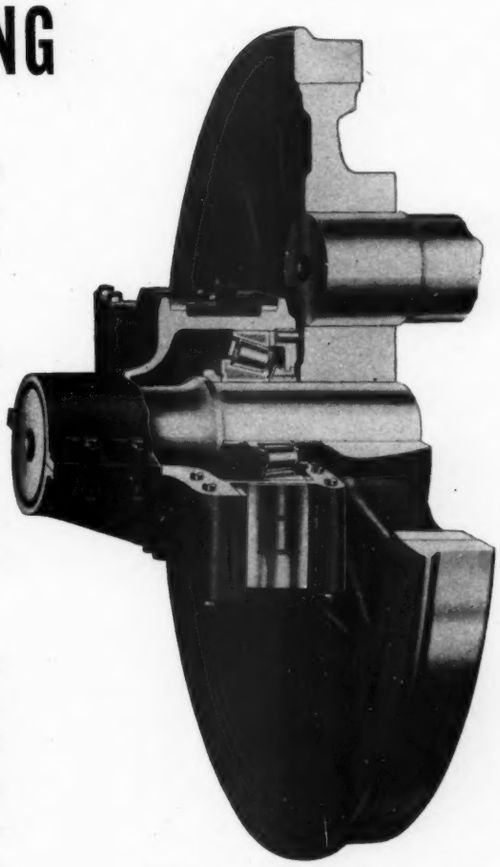
It has now been definitely proved that locomotive driving wheel tires last considerably longer when the driving axles are mounted on TIMKEN Bearings. The intervals between tire turnings are also greatly increased.

This is due to the fact that Timken Bearing Equipped driving axles are perfectly aligned and squared with the locomotive frame and with each other, enabling close operating clearances to be constantly maintained. As a further result, greatly increased smoothness of locomotive operation is also secured, because the wheels are kept round due to the effect of true revolving action.

A Timken Bearing Equipped locomotive is given a permanent "operating lateral" when it is built. No breaking-in is required. On the other hand in a friction bearing locomotive the lateral between the boxes and hub liners is set up very close to begin with so as to allow for wear during the running-in period. However, by the time the locomotive "frees itself" the driving box lateral is usually too great and must be closed up again.

Railroads operating Timken Bearing Equipped locomotives have found that they can run these engines from 100,000 to 125,000 miles before dropping the wheels to turn the tires. This compares with from 35,000 to 75,000 miles in the case of friction bearing locomotives of the same type. One railroad has advised that they expect to get 200,000 miles before dropping the wheels to turn the tires!

Furthermore, the perfect wheel and axle alignment and free lateral conditions of Timken Bearing Equipped locomotives are reflected in the longer life of driving rods, motion work and other moving parts of the locomotive.



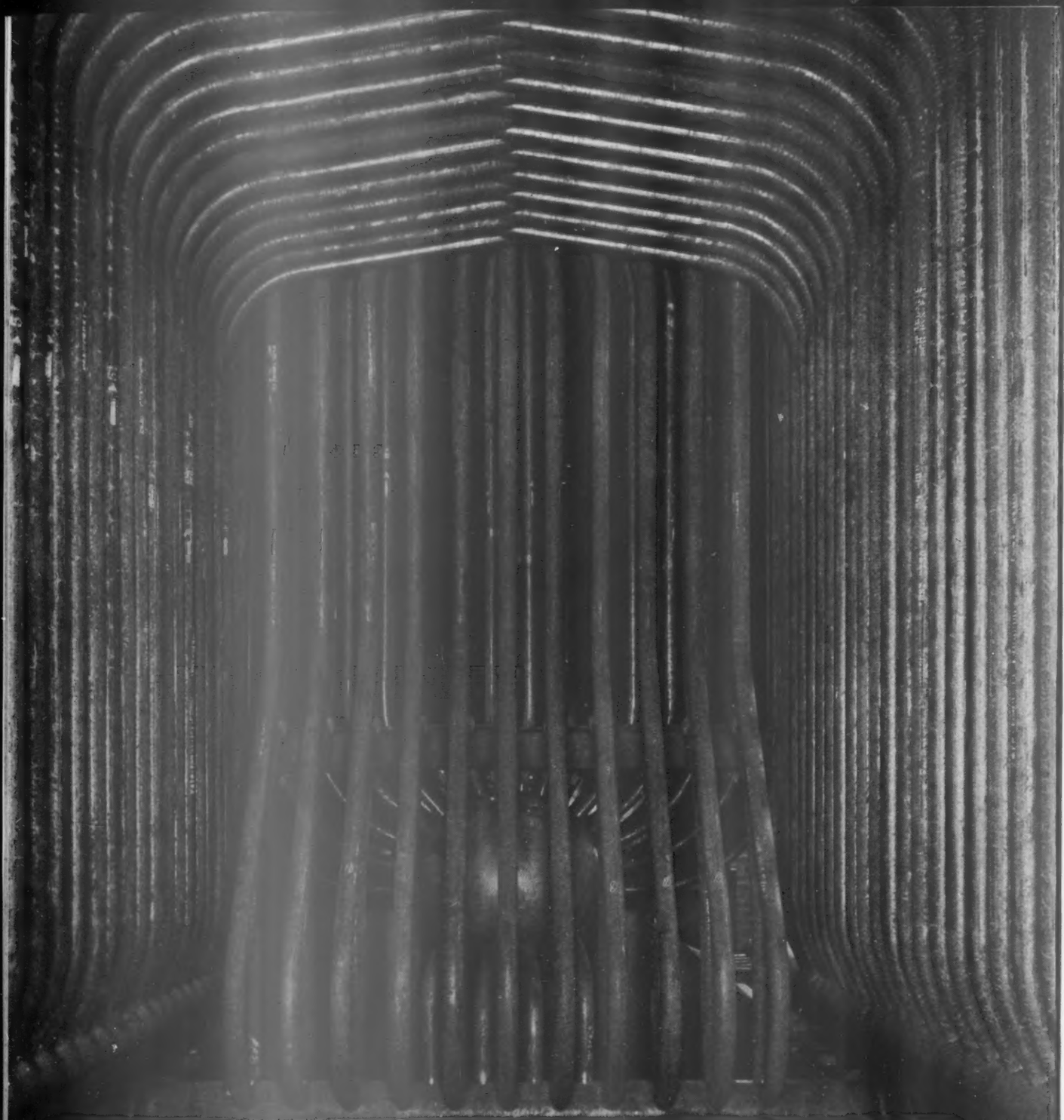
A typical TIMKEN Railway Bearing driving axle application for steam locomotives.

The Pennsylvania's new Broadway Limited rolls on TIMKEN Bearings.
GLIDE—as you ride a Timken Bearing Equipped train

THE TIMKEN ROLLER BEARING COMPANY, CANTON, OHIO

Manufacturers of TIMKEN Tapered Roller Bearings for automobiles, motor trucks, railroad cars and locomotives and all kinds of industrial machinery; TIMKEN Alloy Steels and Carbon and Alloy Seamless Tubing; TIMKEN Rock Bits; and TIMKEN Fuel Injection Equipment.

TIMKEN
RAILWAY ROLLER BEARINGS



Here's Your Opportunity to Learn All About —

ELECTRUNITE

REG. U.S. PAT. OFF.

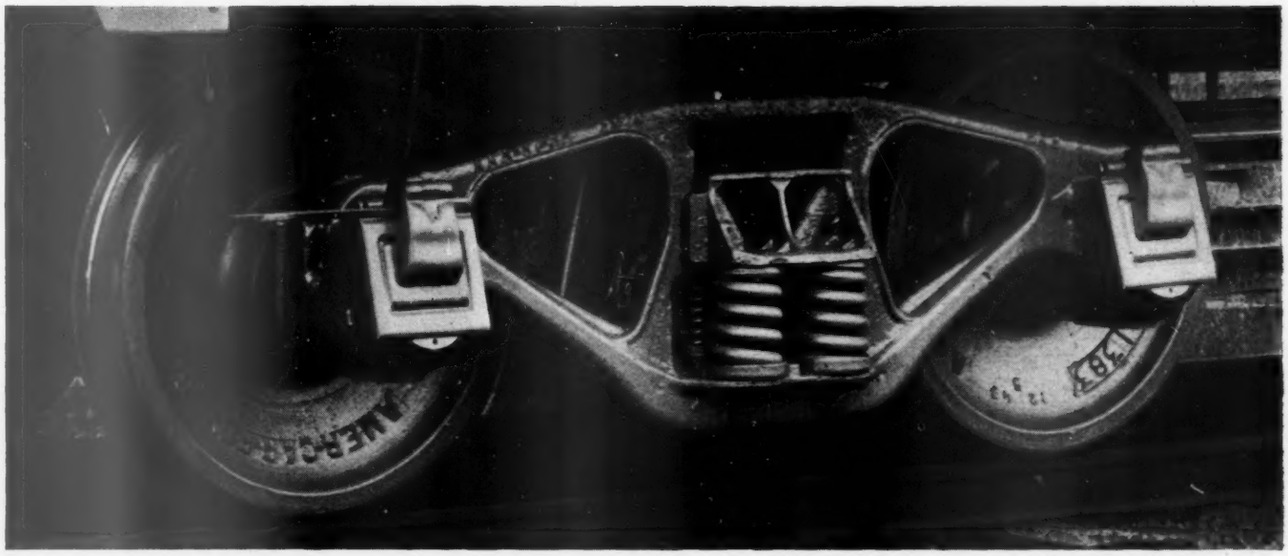
STEEL AND TUBES ELECTRIC WELD

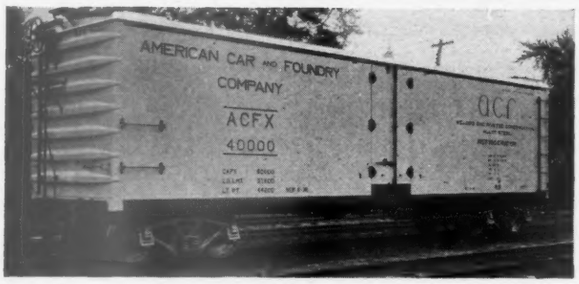
BOILER TUBES

If you attend the Power Show, be sure to visit the ELECTRUNITE exhibit at Booth 10. There you will have an opportunity to learn all about the many features of this modern boiler tube and why each year more users are turning to ELECTRUNITE. • Should you not be able to visit the show, your nearest ELECTRUNITE distributor will gladly give you this information. See him or write us. Steel and Tubes, Inc., Cleveland, Ohio. (Subsidiary of Republic Steel Corp.)

YOU'LL FIND ELECTRUNITE AT BOOTH 10 AT THE POWER SHOW, GRAND CENTRAL PALACE, NEW YORK CITY, DECEMBER 5th TO 10th

BARBER
STABILIZED TRUCKS *Selected*





Upper illustration shows the Barber Stabilized Truck, Type S-2, used under the new American Car and Foundry exhibit refrigerator car. Barber trucks can be used with or without spring planks. Designs available for all capacities and also for 4-wheel tender trucks.

BARBER Stabilized Trucks *Save You More for More Years*

. . . *for Latest*
Light Weight, Welded, All Steel REFRIGERATOR CAR

built by American Car and Foundry for exhibit purposes.

The BARBER truck is built on sound engineering ideas. It is *initially tight* and STAYS tight. Rugged, large-area friction members act against wear plates on columns, eliminating all *looseness and wear* between bolsters and columns.

Any slight wear that may develop in friction members from years of service is automatically taken up.

Bouncing action is positively controlled, smooth riding assured, lading damage claims reduced and spring breakage eliminated.

Purdue tests show that frictional resistance between wear plate and friction block is correctly proportioned according to load in car body.

The BARBER Stabilized Truck is the TRUCK TO USE for the solution to numerous problems in the maintenance and operation of freight equipment.

STANDARD CAR TRUCK COMPANY
332 SOUTH MICHIGAN AVENUE CHICAGO, ILLINOIS

GET TOGETHER DEPARTMENT

POSITIONS OPEN POSITIONS WANTED

WANTED

TRUCK SIDE FRAMES, Freight Car
From dismantled cars or surplus stocks

IRON & STEEL PRODUCTS, INC.
Chicago (Hegewisch Sta.), Ill.
Buyers Sellers Traders
"Anything containing IRON or STEEL"

Classified Advertisements—Help and Situation Wanted advertisements appearing in the "Get Together Department," 10c a word an insertion. Minimum charge $2.00 for each insertion. For Sale Advertisements $10.00 a column inch. Any number of inches may be used. Copy must be in this office by the 10th of each month preceding to insure insertion in the issue.

THE EDITOR'S DESK

MERRY CHRISTMAS AND A HAPPY NEW YEAR

It is physically impossible to express our holiday greetings to most of you in person, and so we take this opportunity of wishing each and every one of our good friends among the Readers and Advertisers a Merry Christmas and a Happy and Prosperous New Year.

The experts who diagnose car loadings and business trends tell us that, relatively, there has been a steady improvement during recent months. There seems to be almost a unanimity of belief that home building in the United States will be greatly stimulated in 1939. This, in itself, will mean much to the railroads and transportation agencies.

Not all the economists agree in their predictions, but marked improvement in other lines of industry and commerce is predicted by many of them. This should have a good effect upon railroad earnings. For the mechanical department, in particular, it means that shops and repair plants will become more active and that many furloughed employees will be called back into service. Experience over the years indicates that the railroads will spend at least as much in purchases of equipment, facilities and materials as they earn in net income—possibly more if business prospects continue to be favorable and money for rehabilitation can be secured at low interest rates.

Regardless of what one may think of the wage settlement, there seems to be little question but what the labor leaders and employees recognize that an unusual degree of co-operation will be required of them if the railroads are to continue as a private enterprise—and judging from the expressions and attitude of some of the labor leaders, we can expect close and cordial co-operation from the workers in helping to restore prosperity to the railroads.

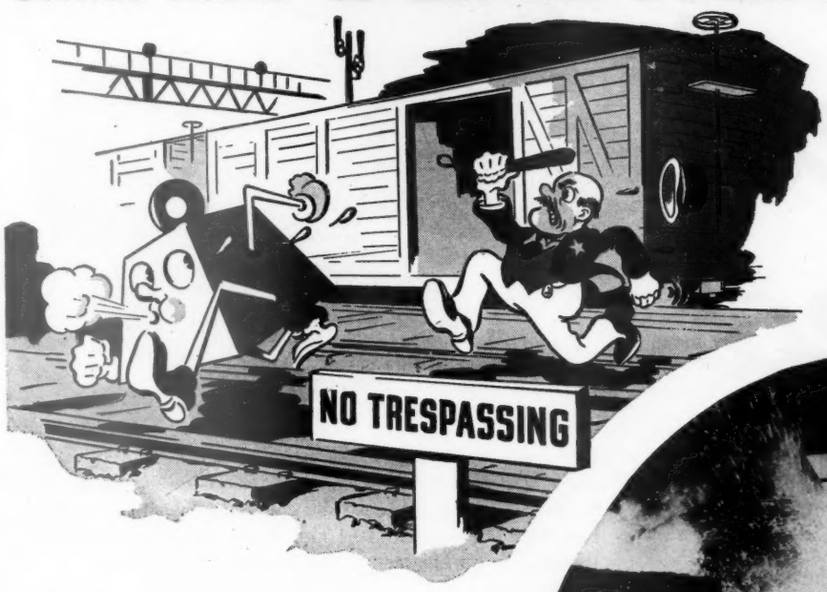
The leaders of the Administration and the public, quite generally, have indicated that there must be remedial legislation which will remove unfair handicaps from the railroads and make it possible for them to get back on a sound, prosperous basis. It is true that some of the legislators and regulators in a self-righteous way persist in the attitude that railroad managements are solely at fault and that they must be soundly spanked before relief will be granted. Public opinion, however, is becoming exceedingly critical of the leaders who have stood in the way of granting relief to the railroads and let us hope that the public will have its way and that we will see real, constructive leadership on the part of the Administration and Congress, which will give the railroads a square deal, and that is all that they want. Surely this is not expecting too much!

Our wish for a prosperous New Year, therefore, is not just an idle sentiment, but seems to have a sound and realistic basis.

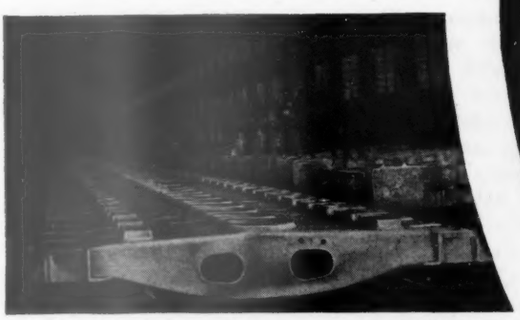
Sincerely,

Roy V. Wright

Chase those DEADHEAD TONS *with* CAST NICKEL STEELS



You chase free riders from your freights but are you stopping the most *flagrant* operating loss — the wasted cost of hauling millions of tons of useless deadweight in old type equipment? You can stop that needless loss by using modern Nickel cast steels for important rolling stock castings.



(Above) *A group of truck bolsters made of Nickel cast steel. Union Pacific officials, ordering new freight cars, saved 20-25% under casting weights by specifying Nickel cast steels in truck bolsters made by Buckeye Steel Castings Company.*

BUCKEYE COMPOSITION (Average)

Carbon	0.28 %
Manganese	1.50 %
Nickel	1.40 %
Silicon	0.35 %
Phosphorus	0.030% max.
Sulphur	0.025% max.

PHYSICAL PROPERTIES

	Minimum Requirements	*Typical (1) Results*
Ultimate Tensile Strength	90,000 lbs./sq. in.	95,100 lbs./sq. in.
Yield Point	60,000 lbs./sq. in.	63,840 lbs./sq. in.
Elongation in 2"	22%	26.6%
Reduction of Area	45%	57.9%

STATIC TEST RESULTS

Bolsters:	Minimum allowable breaking load	423,500 lbs.
	Actual breaking load	509,200 lbs.
Yokes:	Minimum allowable breaking load	550,000 lbs.
	Actual breaking load	655,300 lbs.

(1) Heat Treatment: Normalize at 1600° F., air cooled and subsequent tempering at 1100° F. Typical results taken on test bars attached to castings.

(Left) *5,200 light weight cast steel draft yokes were recently completed for the Union Pacific by Buckeye Steel Castings Company. This Columbus, Ohio, railroad foundry pioneered development of high-strength Nickel alloy cast steels. Nickel adds toughness, assures uniformity.*

THE INTERNATIONAL NICKEL COMPANY, INC., NEW YORK, N.Y.

One OF THESE IS Hard Boiled

The hardboiled egg, although it looks just like the other, has been given something "extra." So, too, Ex-Cell-O railroad pins, or bushings, may appear the same as others, but they have been ground after hardening to give them extra life.

Here is how Ex-Cell-O pins and bushings are made to stand up longer, why their long life reduces other maintenance expenses, and what their use has done for certain railroads:

How Ex-Cell-O Pins and Bushings Are Made

Ex-Cell-O pins and bushings are made of S. A. E. No. 1010 steel, in the standard sizes listed in our catalog. After machining, they are carburized, and allowed to cool; this refines the cores, and makes them ductile to withstand shocks in service. Then the pins and bushings are re-heated, and quenched in oil and brine; this produces a uniform surface hardness, from $\frac{1}{32}$" to $\frac{1}{16}$" deep, that withstands service wear. They now have a hardness of 60 Rockwell "C" scale, or 610 Brinell, and a minimum tensile strength of 55,000 lbs. per sq. in. that withstands cracking and shearing. The heat treatment used is standard S. A. E. IV.

After hardening, Ex-Cell-O pins and bushings are ground to a smooth finish on all wearing surfaces. A tolerance for size of .002 inch is held in grinding on the outside diameter of the pins, and on the inside diameter of the bushings. The inside and outside diameters of the bushings are ground concentric within .005 inch indicator reading. This precision grinding produces a smooth bearing between pins and bushings. Ex-Cell-O pins and bushings of the same size are interchangeable, and all conform to A. A. R. Specifications.

Wear is Slow and Uniform

Ex-Cell-O pins and bushings are used for locomotive driver brakes, spring rigging and frames, and for passenger car and tender trucks, brake rigging and frames. Wear on Ex-Cell-O pins and bushings occurs slowly—one or two thousandths of an inch wear is noticeable only after two or three hundred thousand miles of service. This wear is evenly distributed, over all wearing surfaces. The reason is that Ex-Cell-O pins and bushings are smooth and uniformly hard.

Dirt, cinders and other abrasive particles from the roadbed do not form heavy deposits which might cause seizing and brake failures; instead, they are pulverized between the bushing and pin, and ejected in the form of dust. The cotter hole in the pin does not become distorted by wear, which might allow the cotter key to work free and thus permit the pin itself to fall out.

Even distribution of wear on the surfaces of Ex-Cell-O pins and bushings also maintains the alignment of foundation parts, such as springs, levers, hangers, airbrake parts, brake heads and brake shoes. Brake shoes do not over-ride the wheel rims, and the possibility of thermal check is thus reduced. There is no lost motion in brake applications; therefore fewer emergency applications are necessary.

Because wear on Ex-Cell-O pins and bushings occurs slowly and is uniformly distributed, their condition and probable remaining life are accurately determined on scheduled inspections. This eliminates failures in service—failures that would interrupt train schedules while running repairs were made, or would cause rough riding and cocking. Cocking would in turn accelerate wear, and even necessitate replacement of expensive foundation parts.

What Railroads Have Found

Actual reports, typical of those received from more than 100 railroad customers: (Railroad A) $30,000 annual saving is being made on 515 freight and passenger locomotives equipped with Ex-Cell-O pins and bushings in spring and brake rigging. (Railroad B) This railroad was the first one to make a trial application of Ex-Cell-O pins and bushings, to a dining car seven years ago. This car has since seen about 700,000 miles of service, but the original Ex-Cell-O pins and bushings have not needed replacement. (Railroad C) Ex-Cell-O pins and bushings have outworn the parts to which they were applied. (Railroad D) All passenger cars equipped with Ex-Cell-O pins and bushings four years ago; no replacements necessary since then. (Railroad E) Saves $5.00 apiece by reclaiming brake beam struts having worn fulcrum holes, with Ex-Cell-O pins and bushings. Detailed information, including the names of these railroads is available.

The experience of more than 100 railroads, both major and short-line, with Ex-Cell-O pins and bushings indicates savings of over $125.00 a year are obtainable on each tender and passenger car. Greater savings are possible on locomotives.

All rolling stock can be equipped from the 148 standard sizes of Ex-Cell-O pins and bushings. They are carried in stock, and can be shipped immediately. Your railroad is thus able to reduce inventories and make a further saving.

You can determine the reduction in maintenance cost on your own equipment by making a trial application of Ex-Cell-O pins and bushings. Check them for size and alignment at every shopping. Then compare their life and cost per mile with that of the pins and bushings you are now using. You will find that a substantial saving can be made by completely equipping your rolling stock with pins and bushings made by the Railroad Division, Ex-Cell-O Corporation, 1226 Oakman Boulevard, Detroit, Mich.